Technical Report 1400

Investigating Army Officer Classification: Validation and Utility of Pre-Commissioning Metrics to Enhance Junior Officer Performance

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14. ABSTRACT *(Maximum 200 words)*:

The U.S. Army Cadet Command (USACC) uses a multi-step process to assign newly commissioned officers to specific branches. This branching process incorporates numerous metrics and dynamics (e.g., USACC Cadet Outcome Metric Score, OMS), cadet branch preference, gender & ethnic branch distributions, and operational requirements). The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducted research to simulate the USACC branching process and model the use of pre-commissioning and non-cognitive metrics to improve junior officer performance and career continuance. To create the simulation, ARI validated pre-commissioning- and non-cognitive metrics against officer performance and continuance indices that were collected two to eight years later. Predictor data included: pre-commissioning metrics such as USACC Cadet OMS and its component scores; as well as non-cognitive metrics derived from the Cadet Background and Experience Form (CBEF) scales, the Leader Knowledge Test (LKT), and the Work Values Inventory (WVI). Criteria included supervisor ratings of officer in-unit performance as well as archival data. The validity analyses based on approximately 2000 officers quantified the potential of cadet pre-commissioning and non-cognitive metrics to predict long-term officer performance, and the simulation analyses demonstrated that this information can be used to improve junior officer performance by better matching cadet characteristics with officer branch requirements.

15. SUBJECT TERMS
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INVESTIGATING ARMY OFFICER CLASSIFICATION: VALIDATION AND UTILITY OF PRE-COMMISSIONING METRICS TO ENHANCE JUNIOR OFFICER PERFORMANCE

EXECUTIVE SUMMARY

Research Requirement

The U.S. Army Cadet Command (USACC) assigns newly commissioned officers to branches to address U.S. Army operational goals and ensure operational readiness (e.g., meeting personnel strength and manning distribution requirements, distributing high quality leaders and officer demographics across branches). The branching process is also intended to align the capabilities of junior officers with occupational requirements to improve the in-unit performance of these individuals and encourage them to pursue long-term careers in the military.

However, there is little empirical evidence that this system results in newly commissioned officers being assigned to those branches in which their performance and/or long-term- continuance is maximized. Therefore, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducted analyses to identify and evaluate possible improvements to the process that USACC uses to assign newly commissioned officers to their initial branches.

Procedure

For over a decade, USACC and ARI collected pre-commissioning and non-cognitive data from Reserve Officers' Training Corps (ROTC) cadets who attended the ROTC Advanced Camp field training exercise during the summer preceding their senior year in college. The predictor data for this project were collected for seven ROTC cadet cohorts who became commissioned officers between 2010 and 2016.

Pre-commissioning variables reflecting cadet performance throughout their ROTC experience were drawn from USACC records. These variables included (a) the USACC Cadet Outcome Metrics Score (Cadet OMS), (b) three components of Cadet OMS (Academic OMS, Leadership OMS, and Physical OMS), and (c) two measures derived from USACC databases (Predicted Branch Fit and College Quality Index). Additional predictor scores came from the Cadet Background Experiences Form (CBEF), which was administered during the ROTC Advanced Camp field training exercise prior to their senior year in college and before becoming commissioned officers. The CBEF contained: (a) a variety of biodata scales, (b) the Leader Knowledge Test (LKT), and (c) the Work Values Inventory (WVI). The pre-commissioning and non-cognitive predictors were organized into 14 predictor composites based on historical, theoretical, and correlational relationships among these measures.

Criterion data were collected 2-8 years following the collection of the predictor data (i.e., using a longitudinal predictive design). Criterion data included (a) supervisors' ratings of junior officer in-unit performance using Junior Officer Performance Rating Scales (JOPRS), (b) junior officers' self-reported career continuance expectations reported on a Junior Officer Survey (JOS) and (c) training, performance, and continuance indicators from U.S. Army administrative records (e.g., Basic Officer Leader Course – B (BOLC B) recycles; Awards for meritorious service; and attrition/separation indices).

The performance criterion variables were organized into an overall performance composite. This composite was a weighted score computed across eight performance factors. While narrower composite scores were investigated, the narrower criterion composites were highly correlated with the more comprehensive Weighted 8-Factor Composite. Therefore, the Weighted 8-Factor Composite was the principal performance composite for the validation and simulation analyses.

The ROTC Sample contained information collected for cadets who became commissioned officers through the ROTC program from 2011 through 2017 ($N = 33{,}613$). The ROTC Sample had two subsamples. The Active Duty Sample included junior officers who joined the Active Duty component ($n = 20{,}359$). The Validation Sample included officers in the Active Duty Sample for whom ARI obtained high quality predictor and criterion data ($n = 2{,}717$). Validation Sample sizes for branches ranged from $n = 15$ for the Cyber branch to $n = 318$ for the Military Intelligence branch. Therefore, the officer branches were organized into branch clusters that were based on Army functional groups in order to conduct empirical analysis.

Correlation and hierarchical regression analyses were used to evaluate the validity of the 14 predictor composites against the criterion composites, as well as the incremental validity of the 14 predictor composites beyond the Cadet OMS against the criterion outcomes. In addition, Bayesian Model Averaging (BMA) procedures were used to estimate the relative importance of the predictor composites for predicting officer performance and career continuance outcomes.

Validity estimates (e.g., regression weights) were used as input for classification modeling and algorithm development. The classification algorithms and simulation models were primarily designed to maximize mean predicted officer performance and enhance career continuance.

Findings

Analyses of the Validation Sample, without regard to branch cluster, showed that the Cadet OMS metric was a significant predictor of in-unit performance. Hierarchical regression analyses demonstrated that the pre-commissioning- and non-cognitive predictor composites provided incremental validity beyond the Cadet OMS metrics against the in-unit job performance composites. Based on bivariate validities and BMA results, the Leadership OMS component was the most consistent predictor of in-unit job performance across branches and rank (Lieutenant vs. Captain).

Regarding prediction of performance by branch cluster, BMA analyses showed:

- The Leadership OMS score was a positively weighted critical predictor of overall performance in almost all branch clusters.

- Knowledge of leadership requirements as measured by LKT scores was often a critical predictor of overall performance, but the scores were weighted positively for some branch clusters and negatively for others. This result suggests that the LKT might be a useful differentiator across branch clusters.

- The CBEF Tolerance predictor composite (measured by CBEF scales) was a more critical predictor of performance for some branch clusters than others.

The simulation indicated that branch assignment based on the pre-commissioning and non-cognitive metrics would substantially improve officer job performance for four branches (Military Intelligence, Signal Corps, Cyber, and Medical Service Corps) and modestly improve officer job performance for six branches (Chemical Corps, Air Defense Artillery, Ordnance Corps, Transportation Corps, Quartermaster Corps, and Adjutant General Corps). However, a greater range of predictor measures may be needed to improve the performance of officers assigned to the Infantry, Armor, and Aviation branches (i.e., the available predictor metrics yielded only minor improvements in officer job performance for those branches).

Use and Dissemination of Findings

These results establish the long-term predictive validity of cadet pre-commissioning and non-cognitive measures against metrics of junior officer performance and career continuance that were collected approximately 6 years after the cadets became commissioned officers. These findings support the use of the Cadet OMS and its component metrics to assign newly commissioned officers to critical positions. These results also demonstrate that USACC commissioning programs have been highly effective in developing and measuring cadet capabilities that are critical to their subsequent performance as junior officers when assigned to operational units.

In addition, these results justify the use of the Cadet OMS as the principal criterion against which to validate non-cognitive measures that are used to award ROTC scholarships. Because the Cadet OMS is a valid surrogate of the future in-unit performance of junior officers, this approach helps ensure ROTC scholarships will be awarded to individuals who are most likely to become high performing U.S. Army officers. Therefore, the results of this project can help inform revisions of the CBEF, as well as judgments about which of its scales may be most useful to complement the existing scholarship award process.

The validity analyses and the classification simulations indicate that pre-commissioning and non-cognitive metrics have potential to improve the USACC branch assignment process for newly commissioned officers by better aligning cadet capabilities with officer branch requirements, thereby improving in-unit officer performance. It follows that improved branch assignment algorithms could be used to directly guide the branch assignments for newly commissioned officers or to counsel officer candidates on the branches that represent the "best" fit for them.

The primary limitation of this research is that the available pre-commissioning and non-cognitive predictors were primarily designed to predict overall officer performance and continuance. While several of those predictors have differential validity across branches, these predictors were not specifically developed for the purpose of branch assignment. Therefore, larger gains in officer performance are expected for predictors that are specifically designed to reflect specific branch performance requirements. To address this limitation, ARI has initiated a follow-on project to develop branch-oriented non-cognitive predictors of officer job performance and continuance.

INVESTIGATING ARMY OFFICER CLASSIFICATION: VALIDATION AND UTILITY OF PRE-COMMISSIONING METRICS TO ENHANCE JUNIOR OFFICER PERFORMANCE

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CHAPTER 1: INTRODUCTION

Peter J. Legree and Laura A. Ford

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has supported an ongoing program of research to develop, validate, and implement personnel assessment measures to address U.S. Army officer selection and classification goals since 2007. This research program has primarily focused on validating non-cognitive predictors (e.g., the Cadet Background and Experience Form [CBEF]) against metrics of cadet performance and continuance (Bynum & Young, 2019; Legree et al., 2014; Putka et al., 2009). Based on these analyses, the U.S. Army Cadet Command (USACC) has implemented the CBEF to help award scholarships to individuals who are likely to perform well in Reserve Officers' Training Corps (ROTC), complete pre-commissioning training, and become commissioned officers.

Preliminary longitudinal analyses have demonstrated that non-cognitive and pre-commissioning metrics are valid predictors of junior officer performance metrics collected at their initial duty assignments (Legree et al., 2019). In addition, these results affirm the potential use of non-cognitive and pre-commissioning metrics as predictors of long-term officer performance. These findings support U.S. Army personnel selection goals by demonstrating that non-cognitive and pre-commissioning metrics can be used to identify individuals who are likely to become high performing officers regardless of their branch assignment.

However, the potential use of pre-commissioning and non-cognitive metrics to enhance the effectiveness of the U.S. Army Officer Corps by improving the match between officer characteristics and branch requirements has not been established. Evaluating this possibility requires: (a) identifying measures that have differential validity across branches; and (b) showing that these measures can improve the aggregate performance of the officer corps by improving the branch assignment process. The current effort focused on evaluating the relationship among predictor (collected pre-commissioning) and criterion (collected post-commissioning) measures to develop computer models for optimizing officer performance and continuance. These results provide the empirical foundation to address personnel classification goals for U.S. Army officers.

It is critical to recognize that conventional selection procedures have limited utility to support classification goals when multiple occupations compete for the same high-quality individuals identified using a single predictor composite. Therefore, numerous officer branches cannot be assigned disproportionately large numbers of high-quality cadets using a single predictor composite or highly redundant predictor composites (Brogden, 1958; Zeidner, Johnson & Scholarios, 1990). Meeting these personnel classification goals requires (a) composites with differential validity to identify individuals who would perform very well in specific occupations, but only modestly or poorly in other occupations; and (b) simulation analyses to model the effects of the classification composites on the aggregate performance of the officer corps.

In addition, operational and practical constraints may limit the effectiveness of any classification algorithm. For example, U.S. Army policy to balance demographic characteristics across branches may conflict with using classification algorithms to optimize the performance of the officer corps. Likewise, ignoring cadet preferences when assigning branches may undermine U.S. Army efforts to motivate individuals to perform well in pre-commissioning programs and pursue a long-term military career. Therefore, a simulation approach is required to model performance gains that could be obtained by modifying the branch assignment process.

Research Objectives and Approach

The overall objective of this effort was to identify and empirically evaluate procedures that could be used to support U.S. Army personnel classification goals. Specifically, the project was undertaken to determine if the aggregate performance of the U.S. Army Officer Corps could be improved by better aligning officer capabilities with branch requirements. Our approach to this project required the following:

1. Predictor Data: We gathered operational and research data to identify potential predictors of officer branch performance for ROTC commissioned officers. These data were originally collected when the officers were ROTC cadets and correspond to officer cohorts commissioned between 2011 through 2017.
2. Criterion Performance Data: We collected performance ratings from the direct supervisors of junior officers who were assigned to operational units using in-person and online questionnaires. These data were supplemented with information derived from U.S. Army personnel records.
3. Criterion Career Continuance Data: We collected self-assessment data from junior officers to quantify their branch satisfaction and career continuance expectations. These data were also supplemented with information from U.S. Army personnel records.
4. Project Dataset Construction: We combined the predictor and criterion datasets using personal identifiers to create a Validation Sample dataset.
5. Validity Analyses: We used the Validation Sample dataset to empirically identify valid predictors of officer branch performance and career expectations and assessed the differential validity of branch-level predictor composites against these criteria.
6. Development of Officer Performance Models: We developed separate models to optimize officer corps performance and continuance, respectively. These models were also constrained to reflect U.S. Army operational policy and practical constraints (e.g., officer quality and demographic distribution goals, cadet preferences).
7. Optimization Algorithms: We evaluated the potential of the resulting algorithms and associated individual difference measures to guide branch assignments for newly commissioned officers. This information could also be used to counsel officer candidates on the branches that represent the “best” fit for them.

This project required a multi-year effort to gather available predictor data, develop data collection instruments for performance and continuance criteria, collect criterion data, construct the Validation Sample dataset, conduct validity analyses for individual branches, and most importantly, model the impact of using these predictors to guide officer branch assignment under various U.S. Army policy constraints.

U.S. Army Branch Assignment Objectives

Newly commissioned U.S. Army officers are generally assigned to 1 of 17 branches. These 17 branches include: Adjutant General, Air Defense Artillery, Armor, Aviation, Chemical, Cyber, Engineers, Field Artillery, Finance, Infantry, Medical Service, Military Intelligence, Military Police, Ordnance, Quartermaster, Signal, and Transportation. The officer branch assignment process is constrained by U.S. Army policy objectives:

1. Meeting Army strength and manning distribution requirements.
2. Ensuring that higher quality leaders are distributed among all branches.
3. Balancing officer demographic characteristics across branches.
4. Assigning cadets to the branches where they will likely perform well.
5. Maximizing cadet satisfaction by assigning individuals to their preferred branches.
6. Assigning branches to increase officer career satisfaction and career continuance.

These objectives often conflict with each other. For example, assignments that maximize performance might assign a disproportionate number of the highest potential cadets to a few branches, thereby resulting in the inequitable distribution of high-quality leaders across branches. The current process of assignment seeks to balance these conflicting objectives by meeting the minimum standards for each branch. Although this process is designed to satisfy numerous criteria, there is little empirical evidence that it produces an officer corps that maximizes officer performance and career continuance outcomes. Therefore, the impetus for this research was to provide empirical analyses to improve the branch assignment process and effect improved officer performance and continuance.

U.S. Army ROTC Branching Process

The ROTC branching process has been primarily based on cadet ranking on the USACC Cadet Order of Merit List (OML), cadet branch preference, and U.S. Army officer branch requirements. In the fall of each year, cadets expecting to graduate from college submit their top three branch preferences for consideration. Although the specifics of the branch assignment process are frequently modified, cadets have been traditionally ranked from highest to lowest on the Cadet OML for each cohort. The Cadet OML score is based on their Cadet Outcome Metrics Score (OMS), and the Cadet OMS is based on various academic, leadership, and physical outcome variables that are collected during ROTC. The Cadet OML Model for fiscal year (FY) 2017 calculated the Cadet OMS using the following weightings for these components:

- Academic Outcomes (50%) – Based on standardized test scores, Accessions grade point average (GPA), Cadet Development Assessment, Academic Discipline, and command interest items.
- Leadership Outcomes (35%) – Based on military science experience-based observations, cadet training and extracurricular activities, and language/cultural awareness.

- Physical Outcomes (15%) – Based on Army Physical Fitness Test (APFT) and college athletics participation.

Next, cadets are assigned either to U.S. Army Active Duty or Reserve Components based on their Cadet OML score with higher ranked cadets being assigned to the Active Duty component. The Active Duty allocations are provided by the U.S. Army G-1 and fluctuate annually (e.g., 52% of ROTC cadets were assigned to Active Duty in FY16). Once Active Duty allocations are made, the branching process begins (D. McKinley, personal communication, March 2, 2016). Although the branching process is updated and modified yearly, a description of the FY2017 five-step process provides a general overview:

- *Step 1 – Active Duty top 10% Fill.* Applicants with Cadet OMS in the top 10% of their cohort nationwide receive their first choice of branch for which they are qualified (e.g., those who select Aviation must pass the flight physical).
- *Step 2 – Active Duty top 40% Fill.* Cadets are considered in order of their Cadet OML ranking and placed into one of their top three branch preferences. Cadets may also need to meet additional qualifications for their preferred branch. Forty percent of each branch's openings is available at this stage unless it was filled in the previous step.
- *Step 3 – Active Duty top 55% Fill with extended active duty service obligation (ADSO).* This step allows cadets with borderline Cadet OMSs to obtain their preferred branch by agreeing to increase their ADSO. That is, cadets who have not been assigned in the previous two steps can agree to an increased ADSO for their top two branch preferences but must be qualified for the branch to which they are assigned. At this stage, 55% of each branch's openings are available.
- *Step 4 – Department of the Army Branching Model (DABM).* For the remainder of branching decisions, cadet records are sent to U.S. Army Human Resources Command to be analyzed by the DABM, a computer optimization model that seeks to fill all remaining open positions and balance cadet quality, gender, and race distributions across branches.
- *Step 5 – Talent Management Board*. The Talent Management Board meets to validate the DABM results. The Board can review assignments made in the first four steps, but changes to the initial assignments are rare.

Not all newly commissioned officers serve immediately in the branch in which they are commissioned (i.e., some officers are *branch detailed*). Cadets assigned to one of five donor branches (i.e., Air Defense, Adjutant General, Finance, Military Intelligence, and Signal Corps) are considered for detailing to one of the four recipient branches (i.e., Armor, Chemical, Field Artillery, and Infantry) to meet Army Lieutenant requirements. This process is outside of the branching process, but it is necessary because some branches require more Lieutenants than Captains, whereas other branches require more Captains than Lieutenants. The detailing process "lends" Second Lieutenants from branches where the need for them is relatively low, to branches that require more Second Lieutenants, but relatively fewer Captains. A branch detail lasts for approximately 3 years.

Project Overview

To model the aggregate performance of the officer corps, we replicated the fundamentals of the above branching process using a research-generated branching algorithm. The goals of the branching algorithm were to (a) estimate the effect of branching policy on the distribution of the preferences of assigned branches, predicted performance, branch satisfaction, and likelihood of career continuance (i.e., retention); (b) represent a wide range of officer branching policies, from simple optimizations to multistage processes; and (c) apply the policies to actual and forecasted populations and branch requirements. To provide input for the programming model, we used regression weights computed from validation analyses conducted for this project.

Research Strategy

Our research strategy entailed a four-step process: (a) use pre-commissioning and non-cognitive information that had been collected from cadets in ROTC as predictor data; (b) collect criterion data relating to their branch performance and satisfaction; (c) conduct empirical validation analyses that identify measures to predict criterion variables; and (d) develop and test optimal assignment algorithms to provide recommendations to improve the current branching process.

The overall ROTC Sample consisted of seven cohorts of officer cadets who had attended the ROTC Advanced Camp field training exercise between 2010 and 2016 (N = 33,613). At Advanced Camp, these cadets completed a battery of predictor measures. Three non-cognitive measures were administered to most of these cohorts: (a) the CBEF biodata scales, (b) the Leader Knowledge Test (LKT), and (c) the Work Values Inventory (WVI). Additional pre-commissioning assessment variables available for these cadets are described in Chapter 2.

Criterion measures developed for this project included the (a) Junior Officer Survey (JOS) which was designed to collect self-report information on continuance intentions and branch satisfaction and (b) the Junior Officer Performance Rating Scales (JOPRS) which was used to collect job performance ratings from supervisors. We matched criterion data to predictor data collected from these same officers before they were commissioned (n = 2,717). We subsequently analyzed relationships among the predictor and criterion measures to determine the validity of the predictors. In turn, validity results were used to provide input for developing a computational algorithm that improves officer job performance, and career continuance.

Branch Analyses

This project required us to evaluate the validity of the pre-commissioning and non-cognitive predictors against measures of officer performance and continuance within officer branches. As detailed in *Chapter 2: Methods*, we developed 14 predictor composites that were included in the validity analyses. Given the large number of predictors, we needed to consider minimum sample sizes that would be sufficient for conducting bivariate correlations, regression models, and other statistical analyses within each branch.

Researchers have proposed a variety of formulas for computing minimum sample sizes, with larger numbers of predictors requiring larger samples (Van Voorhis & Morgan, 2007). Based on the inclusion of 14 predictor composites in the validity analyses, the Harris (1985) and Green (1991) formulas suggest minimum sample sizes of 140 and 163 respectively, while the Pedhazur and Schmelkin (1991) recommend a minimum sample size of 30 for each predictor (i.e., 420 for 14 predictors) to minimize shrinkage of R^2 estimates. Given the difficulty of obtaining adequate sample sizes, particularly for some of the smaller branches, we grouped or "clustered" branches to conduct analyses. We wanted these branch clusters to be large enough to yield robust results, but not be too heterogeneous to yield uninterpretable results. Therefore, we sought a minimum sample size of approximately 200 for each branch cluster.

As Figure 1 shows, we created branch clusters, closely aligned to the Army's "functional groups" (U.S. Department of the Army, 2014), to compensate for low sample sizes obtained for specific branches. According to DA PAM 600-3, this organizational schema was designed "to align the functions and skills required" to facilitate the development of officer functional competencies required on the battlefield (U.S. Department of the Army, p. 11). For example, data from Infantry, Armor, and Aviation officers were merged into the *Maneuver* cluster for analysis purposes. To provide context in reporting results, branch clusters were also organized into the Army's higher-level "functional categories": Maneuver, Fires, & Effects (MF&E), Operations Support (OS), and Force Sustainment (FS).

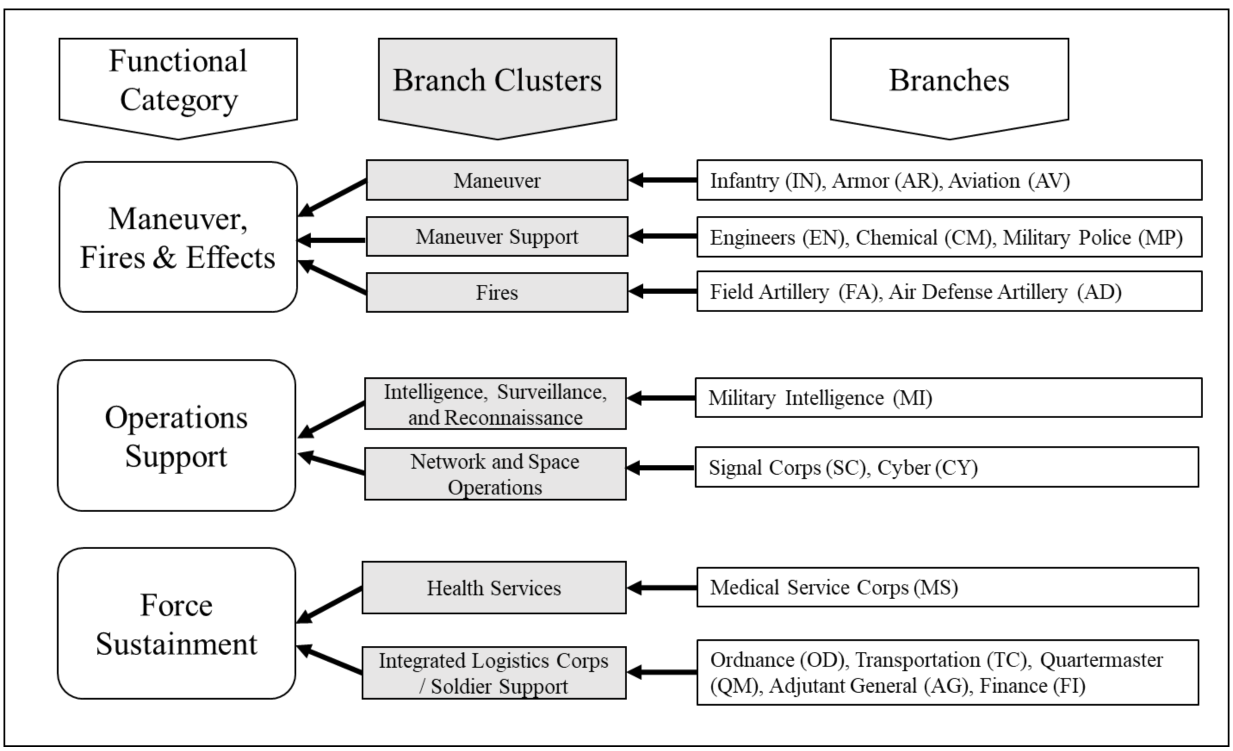

Figure 1. Project organization of officer branches.

In the next chapter, we detail the methods used to collect the data and construct the predictor and criterion composites. In Chapter 3, we describe the validation approach and present the results of the analyses that were conducted to establish the validity of the predictor composites against metrics of officer performance. Chapter 4 describes the procedures that were used to simulate the gains in officer performance and continuance metrics that would be achieved by better aligning cadet capabilities and officer branch performance requirements across the branch clusters. Finally, Chapter 5 discusses general results and implications of these analyses from an operational and research perspective.

CHAPTER 2: METHODS

Christopher R. Huber, Sean P. Baldwin, Amanda J. Koch, Susan D'Mello, Martin C. Yu, Oren R. Shewach, Christopher R. Graves, Justin D. Purl, and Genevieve Ainslie

This chapter describes the methods used to collect data and estimate the validity of pre-commissioning and non-cognitive metrics against in-unit officer performance and continuance outcomes. The first section outlines the overall research design. The second section describes the samples for which archival records were obtained and project data were collected. The third section summarizes the range of predictor data that were available for seven officer cohorts and the development of predictor composites from these data. The fourth section describes the criterion variables and development of the criterion composites.

Design

We used a semi-retrospective design to evaluate the longitudinal validity of pre-commissioning and non-cognitive metrics against outcome measures collected for junior officers who were assigned to operational units in various branches. Our approach constitutes a semi-retrospective design because the predictor data were obtained from archival records, while the criterion data were collected contemporaneously for this project. Therefore, this approach provided a multi-year delay between the collection of the predictor and criterion data, and the analyses provided longitudinal validity estimates for the pre-commissioning and non-cognitive metrics. Results from these analyses were also used as input for the simulation models that were developed to estimate potential gains in junior officer performance and continuance through improved branch assignment (i.e., personnel classification).

Accordingly, ARI used data that had been collected for seven cadet cohorts for whom (a) pre-commissioning data were available from USACC, and (b) non-cognitive data had been collected during USACC ROTC Advanced Camp field training exercise (this exercise occurs during the summer preceding their college completion and officer commissioning). All predictor data represent archival records that were obtained from USACC and ARI datasets. However, the specific predictor scales that were available for each of these cohorts varied because the computation and construction of the pre-commissioning and non-cognitive metrics evolved over this 7-year time span.

In contrast to the extraction of predictor data from archival records, the job performance data were primarily collected from the direct supervisors of junior officers serving in operational units. The career continuance data were primarily collected from the junior officers when they served in operational units. Finally, the supervisor performance rating and the junior officer self-report career continuance data were supplemented by information collected from U.S. Army records. (Additional information describing these data are provided below.)

Samples

We merged archival personnel records (predictor data) with criterion data that were collected at United States Army Forces Command (FORSCOM) operational units. Three sample datasets were developed to support this process and were analyzed for different purposes.

1. The ROTC Sample corresponds to the population of ROTC cadets who attended the USACC Advanced Camp field training exercise between 2010 and 2016 and became commissioned officers between 2011 and 2017 ($N = 33{,}613$). As mentioned above, the specific predictor scales that were available for each of these seven cohorts varied (e.g., cohorts completed different, albeit overlapping non-cognitive predictor batteries at the ROTC Advanced Camp Field Training Exercise.) Due to these data gaps, a common set of predictor composites was created using these data to conduct the subsequent validity analyses.

2. The Active Duty Sample corresponds to those cadets in the ROTC Sample who were commissioned Active Duty and represent the targets of the criterion data collection ($n = 20{,}359$).

3. The Validation Sample corresponds to those officers in the Active Duty Sample for whom we were able to obtain criterion data ($n = 2{,}717$). That is, criterion data were collected in the form of supervisor performance ratings for junior officers in operational units. This dataset was used to estimate the longitudinal validity of the pre-commissioning and non-cognitive metrics against measures of officer performance and career continuance.

Tables 1 and 2 provide sample demographics and cadet cohort information. All data fields were screened to remove records showing careless responding (See Appendix A for data cleaning details).

Table 1. Demographics for ROTC, Active Duty, and Validation Samples

Demographics		ROTC Sample $n = 33{,}613$		Active Duty Sample $n = 20{,}359$		Validation Sample $n = 2{,}717$	
		n	%	*n*	%	*n*	%
Gender	Female	7,140	21.3	4,097	20.1	451	16.6
	Male	26,441	78.7	16,021	78.7	2,262	83.3
Race	African American	3,575	10.7	1,702	8.4	192	7.1
	Asian / Pacific Islander	1,175	3.5	265	1.3	11	0.4
	Caucasian	23,551	70.3	14,696	72.2	2,068	76.1
	Hispanic	3,056	9.1	1,743	8.6	211	7.8
	Native American	830	2.5	872	4.3	128	4.7
	Other	1,295	3.9	830	4.1	102	3.8
Rank	Captain	--	--	7,446	36.6	983	36.2
	Lieutenant	--	--	12,718	62.5	1,725	63.5

Note. Sample sizes for variables may not add up to 100% due to missing data fields.

Table 2. ROTC, Active Duty and Validation Samples by Advanced Camp Cohort

Cohort	ROTC Sample *n* = 33,613		Active Duty Sample *n* = 20,359		Validation Sample *n* = 2,717		Validation to Active Duty Sample Ratio
	n	%	*n*	%	*n*	%	
2010	2,777	8.3	2,454	12.1	224	8.2	.09
2011	4,094	12.2	3,390	16.7	339	12.5	.10
2012	5,364	16.0	2,966	14.6	494	18.2	.17
2013	5,452	16.2	2,918	14.3	550	20.2	.19
2014	5,410	16.1	2,980	14.6	623	22.9	.21
2015	5,569	16.6	3,080	15.1	457	16.8	.15
2016	4,946	14.7	2,179	10.7	30	1.1	.01

Note. Sample sizes for cohorts may not add up to 100% due to missing data fields.

The Validation Sample contains data for approximately 14% of the officers in the Active Duty Sample. Table 3 provides coverage estimates by branch. These estimates ranged from 20% for the Chemical Corps down to 7% for the Adjutant General Corps branch. In general, the sample size for each branch in the Validation Sample was strongly related to the sample size of the Active Duty branch, $r = .95$, $p < .001$.

The limited sample sizes for some branches required that we cluster data for the Validation Sample. These branch clusters are organized by functional category. As shown in Table 3, the largest branch cluster in the Validation Sample was Integrated Logistics Support/ Soldier Support ($n = 646$) and the smallest cluster was Network and Space Operations ($n = 204$).

Table 3. Active Duty and Validation Samples by Branch and Branch Cluster

Branch Cluster and Branch	Active Duty Sample	Validation Sample	Validation to Active Duty Sample Ratio
Maneuver, Fires and Effects (MF&E)			
Maneuver	*3,649*	*525*	
Infantry (IN)	1,911	280	.15
Armor (AR)	784	128	.16
Aviation (AV)	954	117	.12
Maneuver Support	*2,371*	*385*	
Corps of Engineers (EN)	1,187	166	.14
Chemical Corps (CM)	461	92	.20
Military Police Corps (MP)	723	127	.18
Fires	*1,814*	*271*	
Field Artillery (FA)	1,374	205	.15
Air Defense Artillery (AD)	440	66	.15
Operations Support (OS)			
Intelligence, Surveillance, and Reconnaissance	*2,310*	*318*	
Military Intelligence (MI)	2,310	318	.14
Network and Space Operations	*1,630*	*204*	
Signal Corps (SC)	1,529	189	.12
Cyber (CY)	101	15	.15

Table 3. (Continued)

Branch Cluster and Branch	Active Duty Sample	Validation Sample	Validation to Active Duty Sample Ratio
	Force Sustainment (FS*)*		
Health Services	*2,059*	*309*	
Medical Service Corps (MS)	977	175	.18
Nurse Corps (AN)[a]	953	121	.13
Other[a]	129	13	.10
Integrated Logistics Corps / Soldier Support	*4,591*	*646*	
Ordnance Corps (OD)	1,344	174	.13
Transportation Corps (TC)	917	125	.14
Quartermaster Corps (QM)	966	128	.13
Adjutant General Corps (AG)	1,000	66	.07
Finance Corps (FI)	257	27	.11
Logistics (LG)[a]	107	69	.64
Missing	1,935	59	
Total	20,359	2,717	.14

[a] Branch frequency does not add up to branch cluster frequency because direct commission branches and/or the Logistics branch were excluded from analyses (Officers are only branched into Logistics after promotion to Captain and completion of the Logistics Captains Career Course).

Predictor Measures and Composites

The predictor measures included the pre-commissioning metrics from the USACC archival records, and the non-cognitive data that had been collected by ARI at the USACC Advanced Camp field training exercise over the course of 7 years. It should be noted that specific archival and non-cognitive measures that were available for each cohort changed annually, with relatively minor changes associated with the pre-commissioning metrics and more substantial changes associated with the non-cognitive data. Pre-commissioning predictors that were based on USACC archival cadet records include:

- Cadet OMS and its component metrics;
- College attended, which was used to compute the College Quality Index; and
- College major, which was used to compute the Predicted Interest-Branch Fit metric.

Non-cognitive predictors were derived from batteries or scales that had been originally administered to various cadet cohorts at the USACC Advanced Camp field training exercise for related ARI research projects:

- CBEF, which was repeatedly modified over the seven cadet cohorts;
- WVI, which was available for only the first four cadet cohorts;
- LKT, which was available for only the first four cadet cohorts.

Each of these measures is described below.

Cadet Outcome Metric Score and Components

USACC computes the Cadet OMS to quantify overall cadet performance within the ROTC pre-commissioning program. Therefore, Cadet OMS is available for all ROTC cadets who become commissioned officers. As described in Chapter 1, the Cadet OMS reflects Academic (50%), Leadership (35%) and Physical (15%) components.

While Cadet OMS is available for all ROTC cadets who become commissioned officers, the Cadet OMS computational algorithm was modestly revised between 2010 and 2016. Therefore, we standardized the Academic, Leadership, and Physical component scores within cohort to ensure comparability across cohorts.

College Quality Index

One limitation with using undergraduate GPA as a variable to compute the Academic OMS component is that cadets attend hundreds of different colleges with varying academic standards. In addition, analyses have indicated that GPA is a better predictor of officer job performance if it is adjusted for college quality (Koch et al., 2013). Therefore, we created a college quality index as a separate variable and included it in the validation analyses. However, the College Quality Index was not computed for 8% of cadets in the Validation Sample due to incomplete data (e.g., the required metrics for cadets attending small schools could not be estimated). Appendix A provides details.

Predicted Interest-Branch Fit

Congruence between an individual's interests and work requirements may predict job performance (Nye et al., 2017). To leverage this result, we used college majors to infer cadet Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (RIASEC) interest profiles (cf. Holland, 1985).

To create the fit indicators, we computed shape scores as the correlation between each officer's inferred RIASEC profile with the RIASEC profile for each officer's assigned branch (Beyer et al., 2017). Higher shape scores indicate greater congruence between the inferred cadet RIASEC interest profile and the branch profile for the officer's current branch. Branch profiles had been computed for previous research (Koch et al., 2013). Appendix A provides details.

Cadet Background and Experience Form

The CBEF uses rational biodata items to measure non-cognitive attributes. All CBEF scales use a five-point response format (e.g., strongly agree to strongly disagree), and scale scores are computed as the mean item score for each scale. The CBEF has been used and revised extensively for prior ROTC and OCS projects (Allen, Bynum, Erk, Babin & Young, 2014; Allen, Bynum, Oliver et al., 2014; Allen & Young, 2012; Legree, Kilcullen, Putka & Wasko, 2014; Putka, 2009; Russell, Paullin, Legree, Kilcullen & Young, 2017; Russell & Tremble, 2011). Russell and colleagues (2017) studied the validity of 12 CBEF scales, including eight of the scales employed in the present study. They found that most CBEF scales significantly predicted one or more dimensions of officer performance, and several predicted overall performance for platoon leaders, company commanders, and higher-ranking officers.

A total of 17 CBEF scales had been administered to various cadet cohorts who had attended the ROTC Advanced Camp field training exercise between 2010 and 2016. However, five of the 17 CBEF scales were removed from consideration because they were administered to less than three of the seven cohorts. Therefore, we included data for 12 of these 17 CBEF scales. Constructs measured by the 12 CBEF scales are defined in Table 4.

Table 4. Cadet Background and Experience Form (CBEF) Scales

Scale/Item	Definition
Achievement	Willingness to give one's best effort and to work hard towards achieving difficult objectives.
Army Identification	Degree of personal identification with, and intrinsic interest in, being a U.S. Army Officer. Extent to which a respondent feels emotionally attached to the Army.
Fitness	Degree of enjoyment from participating in physical exercise. Willingness to put in the time and effort to maintain good physical conditioning.
General Self-Efficacy	Feeling that one has successfully overcome work obstacles in the past and that one will continue to do so in the future.
Hostility Toward Authority	Belief that superiors abuse their power and take advantage of their employees.
Past Withdrawal Propensity	The tendency to withdraw from commitments (e.g., high school, jobs).
Peer Leadership	Seeks positions of authority and influence. Comfortable with being in charge of a group. Willing to make tough decisions and accept responsibility for the group's performance.
Stress Tolerance	Ability to maintain one's composure under pressure. Remaining calm and in control of one's emotions instead of feeling anxious and worried.
Tolerance for Injury	Tolerance for situations where risk of injury is possible. Attraction to activities involving risk of injury or operating in a dangerous setting.
Oral Communication	The ability to communicate one's ideas by speaking clearly and effectively to others.
Written Communication	The ability to clearly communicate one's ideas in writing to others.
Response Distortion	Special scale designed to detect and adjust for socially desirable responding.

Work Values Inventory

The WVI was administered to the four cadet cohorts who attended the ROTC Advanced Camp field training exercise between 2010 and 2013. The WVI had been developed as a measure of cadet work values and to assess the fit between the cadet's values and those provided in Army officer positions in prior research (Allen, Bynum, Erk et al., 2014; Putka, 2009; Russell & Tremble, 2011; Russell et al., 2017). Examinees rank ordered the importance of 11 job characteristics to their ideal job and identified those characteristics that would need to be present in an ideal job. The WVI profile similarity index (PSI) score (a shape score) was computed as the Spearman correlation between the cadet's rankings and a profile of Army officer job characteristics obtained in prior research (Allen, Bynum, Erk et al., 2014; Putka, 2009; Russell & Tremble, 2011; Russell et al., 2017). Table 5 contains the WVI items.

Table 5. Work Values Inventory (WVI) Items

Scale/Item	Definition
Selfless Service	Contribute to society and the well-being of others.
Leadership Opportunities	Provide guidance and direction to others.
Recognition	Receive recognition or praise for what I do.
Pay	Receive a good salary and benefits.
Structured Work	Have well-defined rules for accomplishing tasks.
Comfortable Work Environment	Work in a comfortable, relaxed environment.
Work Close to Home	Do work that keeps me close to home.
Challenge	Do work that challenges me.
Self-Direction	Come up with my own way to perform tasks.
Teamwork	Work as part of a team.
Variety	Work on a variety of types of problems.

Leader Knowledge Test

The LKT was administered to four ROTC cohorts between 2010 to 2013. It is a measure of implicit knowledge regarding leadership theories and quantifies the extent that the examinee's beliefs regarding leadership requirements match those of other officers (Allen, Bynum, Erk et al., 2014; Legree et al., 2014; Legree et al., 2010; Russell & Tremble, 2011). The LKT asks examinees to rate the importance of various characteristics and skills for being a successful U.S. Army officer using a 10-point importance rating scale. An examinee's LKT responses were scored by calculating shape scores as the product moment correlation between an examinee's ratings and the consensus-based key for each scale (i.e., separate shape scores were computed for LKT Characteristics and Skills scales). Legree and colleagues (2014) reported alpha reliabilities of .82 and .70 for the LKT Characteristics and Skills shape scores for the ROTC cadets who attended Advanced Camp in 2010 (n = 1,471). Table 6 provides definitions for the two LKT scales.

Table 6. Leader Knowledge Test (LKT) Scales

Scale/Item	Definition
LKT-Characteristics	Expectations and beliefs concerning the relative importance of characteristics to officer performance (e.g., creative, mature). Scored as the correlation between a respondent's importance ratings for various characteristics and the mean importance ratings of those from all officers for those characteristics.
LKT-Skills	Expectations and beliefs concerning the relative importance of skills to officer performance (e.g., persuasion, clerical). Scored as the correlation between a respondent's importance ratings for various skills and mean importance ratings from all officers.

Non-Cognitive Predictor Composite Development

We analyzed the non-cognitive data collected for the CBEF, WVI, and LKT to develop a common set of predictor composites for the validity analyses. We used this approach due to ongoing changes to the content of the non-cognitive scales that had been administered to the seven cadet cohorts while at the ROTC Advanced Camp field training exercise. These changes included modifications to many of the CBEF scales and the administration of the LKT and WVI to only four of the seven cohorts. Furthermore, to improve the stability of the composites scores, we based our composite formation analyses using the largest sample (ROTC Sample, $N = 33{,}613$). Use of the ROTC Sample also eliminated the possibility of criterion contamination (i.e., criterion data were not used to create the predictor composites).

Our first step was to identify potential rational composites. We reasoned that the LKT was conceptually different from the CBEF and WVI because the LKT is a knowledge-based scale, while the CBEF and WVI were designed as attitudinal scales intended to measure separate constructs. Therefore, we used scores for the two LKT scales as predictors in our analyses.

Regarding the attitudinal scales (i.e., CBEF and WVI), we identified four potential factor structures, ranging from four to seven factors based on previous analyses (Bynum & Young, 2019). We used confirmatory factor analysis (CFA) with full information maximum likelihood (FIML) estimation to (a) assess the fit of the proposed factor structures and (b) compute composite scores. FIML estimation procedures were used to produce less biased parameters than those produced by multiple imputation, listwise deletion, or pairwise deletion (Enders, 2001). The resulting composite scores were used as predictors in the validity analyses (see Chapter 3).

We used CFA to compare the fit of the four proposed factor structures (i.e., models). Each model included the CBEF scales and the WVI, but the models differed by the number of factors and the scales assigned to the factors. As shown in Table 7, Models 2 and 4 each had six factors. These six-factor models broke Response Distortion out as a standalone factor due to the conceptual distinction from the other scales. Model 3, the seven-factor model, additionally broke Peer Leadership out as a separate factor based on the conceptual relevance of the construct to the current research. Model 3 was the best-fitting option according to several fit indices: Better fit is indicated by lower values for the Chi-squared statistic (χ^2), Akaike Information Criterion (AIC), and Root Mean Squared Error of Approximation (RMSEA) and higher values of the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) (cf. Hu & Bentler, 1999). Therefore, Model 3 was chosen to produce the final predictor composites. Standardized factor loadings for Model 3 appear in Appendix A, Table A.3.

Table 7. Standardized Loadings from the Confirmatory Factor Analyses

Model	Factors	χ^2	CFI	TLI	AIC	RMSEA
Main Model 1	4	17420.841	0.808	0.750	454091.988	0.093
Main Model 2	6	12891.876	0.858	0.787	449579.023	0.086
Main Model 3	7	**11655.522**	**0.872**	**0.787**	**448352.669**	**0.086**
Main Model 4	6	18792.300	0.793	0.695	455477.447	0.103

Note. $n = 33{,}613$ (ROTC Sample). χ^2 = Chi-squared statistic; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; AIC = Akaike Information Criterion; RMSEA = Root Mean Square Error of Approximation. Bolded values show the best value for each fit statistic among the four models.

Table 8 describes the seven factors in Model 3. The final composites are conceptually meaningful and empirically supported.

Table 8. Model 3: Best-Fitting Predictor CFA Model

Factor	Composite	Scales
Cadet Background and Experience Form (CBEF)		
1	Achievement Composite	Oral Communication, Written Communication, Achievement, & General Self-Efficacy
2	Fit/Commitment Composite	Army Identification, Past Withdrawal Propensity
3	Response Distortion Composite	Response Distortion
4	Peer Leadership Composite	Peer Leadership
5	Fitness Composite	Fitness Motivation & Tolerance for Injury
6	Tolerance Composite	Hostility to Authority & Stress Tolerance
Work Values Inventory (WVI)		
7	Profile Similarity Index (PSI)	Profile Similarity Index

Predictor Composite Descriptives

As summarized in Table 9, the analytic procedures described above resulted in a set of 14 predictor composites and metrics that were used to conduct the validity analyses.

Table 9. Final Predictor Composites and Metrics

Predictor Composite	
Cadet Outcome Metric Score (OMS)	
1	Academic Component Score
2	Leadership Component Score
3	Physical Component Score
Cadet Background and Experience Form (CBEF)	
4	Achievement Composite
5	Fit/Commitment Composite
6	Response Distortion Composite
7	Peer Leadership Composite
8	Fitness Composite
9	Tolerance Composite
Work Values Inventory (WVI)	
10	Profile Similarity Index (PSI)
Leader Knowledge Test (LKT)	
11	Characteristics Score
12	Skills Score
Other Predictor Composites	
13	Predicted Interest-Branch Fit
14	College Quality Index

To summarize the development of the 14 predictor composites and metrics: The USACC archival records were used to compute the three OMS component scores (i.e., Academic, Leadership, and Physical) as well as two additional metrics (i.e., Predicted Interest Branch Fit and College Quality Index). Attitudinal scales from the CBEF and WVI were factored to create seven additional predictor composites. Finally, the LKT data were analyzed to develop two additional knowledge-based metrics. We emphasize that only predictor data were analyzed to create these 14 metrics.

Tables 10 to 14 present descriptive statistics and correlations among the final set of predictors for the Active Duty Sample. Table 10 reports descriptive statistics for the Active Duty Sample and by rank (i.e., Lieutenants v. Captains). Effect sizes for differences in scores across ranks range from -0.29 to 0.05, with positive values indicating higher scores for Captains. In general, there were larger between-rank differences for the CBEF scales compared to the Cadet OMS measures. On average, lieutenants had higher scores on the CBEF, whereas Captains had higher scores on the Cadet OMS. Predictor measures with the largest differences include CBEF Tolerance Composite (d = -.29), CBEF Achievement Composite (d = -.19), CBEF Fit/Commitment Composite (d = -.19), and the CBEF Response Distortion Composite (d = -.19). Tables 11 through 13 provide descriptive statistics for predictors by branch cluster organized by functional category; MF&E, OS, and FS. Correlations among predictor scores appear in Table 14. Appendix A provides between-group differences in effect sizes for gender (Table A.4) and race (Table A.5).

Table 10. Final Predictor Composite Score Descriptive Statistics Overall and by Rank

Predictor Composite		Overall *n* = 20,359			Lieutenants *n* = 12,718			Captains *n* = 7,446			
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*d*
Outcome Metric Score											
1	Academic Component Score	18,248	.31	.88	11,542	.30	.90	6,526	.34	.86	**0.05**
2	Leadership Component Score	18,248	.41	.87	11,542	.40	.87	6,526	.44	.85	**0.05**
3	Physical Component Score	17,900	.29	.84	11,198	.27	.83	6,525	.31	.86	**0.05**
Cadet Background and Experience Form											
4	Achievement Composite	17,810	.11	.88	12,091	.16	.89	5,556	-.01	.85	**-0.19**
5	Fit/Commitment Composite	17,810	.13	.82	12,091	.18	.84	5,556	.02	.77	**-0.19**
6	Response Distortion Scale	17,810	-.03	.97	12,091	.03	1.02	5,556	-.16	.83	**-0.19**
7	Peer Leadership Scale	17,810	.08	.98	12,091	.12	.98	5,556	-.01	.97	**-0.13**
8	Fitness Composite	17,810	.15	.80	12,091	.18	.80	5,556	.08	.77	**-0.13**
9	Tolerance Composite	17,810	.08	.80	12,091	.15	.82	5,556	-.08	.72	**-0.29**
Work Values Inventory											
10	Profile Similarity Index (PSI)	17,810	.10	.66	12,091	.12	.62	5,556	.06	.73	**-0.09**
Leader Knowledge Test											
11	Characteristics Score	17,810	.01	.38	12,091	.01	.21	5,556	.01	.59	**-0.01**
12	Skills Score	17,810	.01	.37	12,091	.01	.23	5,556	.02	.57	**0.03**
Other Predictor Composites											
13	Predicted Interest-Branch Fit	9,186	.40	.42	8,145	.40	.42	1,041	.42	.40	0.05
14	College Quality Index	11,706	.68	.83	10,388	.68	.83	1,260	.66	.84	**-0.03**

Note. Negative means indicate lower scores on the predictor variable. *d* = Cohen's *d*; standardized mean difference between Lieutenant and Captain samples. Positive *d* values indicate higher scores for Captains, and negative *d* values indicate higher scores for Lieutenants. Bolded Cohen's *d* values represent differences significant at $p < .05$. Predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 11. Final Predictor Score Descriptive Statistics for Maneuver, Fires, & Effects (MF&E) Clusters

Predictor Composite		Branch Cluster								
		Maneuver *n* = 3,649			Maneuver Support *n* = 2,371			Fires *n* = 1,814		
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Outcome Metric Score										
1	Academic Component	3,352	.47	.91	2,084	.16	.88	1,683	.07	.82
2	Leadership Component	3,352	.82	.81	2,084	.33	.84	1,683	.32	.78
3	Physical Component	3,292	.58	.68	2,007	.26	.84	1,653	.22	.90
Cadet Background and Experiences Form										
4	Achievement Composite	3,216	.25	.84	2,134	.09	.87	1,642	.11	.85
5	Fit/Commitment Composite	3,216	.36	.79	2,134	.16	.81	1,642	.20	.79
6	Response Distortion Scale	3,216	-.12	.86	2,134	.00	.96	1,642	-.08	.89
7	Peer Leadership Scale	3,216	.20	.93	2,134	.05	.97	1,642	.08	.98
8	Fitness Composite	3,216	.57	.71	2,134	.20	.74	1,642	.27	.74
9	Tolerance Composite	3,216	.19	.78	2,134	.11	.80	1,642	.08	.76
Work Values Inventory										
10	Profile Similarity Index (PSI)	3,216	.30	.61	2,134	.12	.64	1,642	.15	.63
Leader Knowledge Test										
11	Characteristics Score	3,216	.01	.39	2,134	.02	.31	1,642	.01	.34
12	Skills Score	3,216	.01	.38	2,134	.01	.32	1,642	.00	.32
Other Predictors										
13	Predicted Interest-Branch Fit	1,920	.31	.39	1,378	.57	.42	1,009	.44	.37
14	College Quality Index	2,253	.77	.81	1,576	.69	.80	1,188	.74	.80

Note. Predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 12. Final Predictor Score Descriptive Statistics for Operations Support (OS) Clusters

Predictor Composite		Branch Cluster					
		Intelligence, Surveillance and Reconnaissance *n* = 2,310			Network and Space Operations *n* = 1,630		
		n	*M*	*SD*	*n*	*M*	*SD*
Outcome Metric Score							
1	Academic Component Score	2,138	.55	.88	1,458	.23	.83
2	Leadership Component Score	2,138	.60	.86	1,458	.23	.83
3	Physical Component Score	2,122	.34	.79	1,440	.16	.86
Cadet Background and Experiences Form							
4	Achievement Composite	2,071	.25	.86	1,448	.06	.91
5	Fit/Commitment Composite	2,071	.20	.79	1,448	.04	.84
6	Response Distortion Scale	2,071	-.02	.98	1,448	.04	1.06
7	Peer Leadership Scale	2,071	.22	.96	1,448	.04	1.00
8	Fitness Composite	2,071	.20	.74	1,448	-.02	.77
9	Tolerance Composite	2,071	.15	.80	1,448	.07	.82
Work Values Inventory							
10	Profile Similarity Index (PSI)	2,071	.15	.62	1,448	.02	.66
Leader Knowledge Test							
11	Characteristics Score	2,071	.03	.27	1,448	.02	.29
12	Skills Score	2,071	.03	.28	1,448	.02	.30
Other Predictors							
13	Predicted Interest-Branch Fit	1,229	.53	.24	878	.15	.55
14	College Quality Index	1,506	.78	.89	1,016	.65	.83

Note. Predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 13. Final Predictor Score Descriptive Statistics for Force Sustainment (FS) Clusters

Predictor Composite		Branch Cluster					
		Health Services n = 2,059			Integrated Logistics Corps/Soldier Support n = 4,591		
		n	*M*	*SD*	*n*	*M*	*SD*
Outcome Metric Score							
1	Academic Component Score	1,635	.64	.78	4,150	.11	.86
2	Leadership Component Score	1,635	.43	.90	4,150	.15	.82
3	Physical Component Score	1,540	.30	.85	4,102	.10	.88
Cadet Background and Experiences Form							
4	Achievement Composite	1,804	.04	.84	4,079	.05	.91
5	Fit/Commitment Composite	1,804	-.03	.80	4,079	.05	.83
6	Response Distortion Scale	1,804	-.05	.95	4,079	.06	1.09
7	Peer Leadership Scale	1,804	-.02	.97	4,079	.03	1.00
8	Fitness Composite	1,804	-.17	.77	4,079	-.01	.79
9	Tolerance Composite	1,804	-.01	.77	4,079	.06	.83
Work Values Inventory							
10	Profile Similarity Index (PSI)	1,804	-.01	.66	4,079	.00	.66
Leader Knowledge Test							
11	Characteristics Score	1,804	.02	.39	4,079	.01	.30
12	Skills Score	1,804	.02	.39	4,079	.01	.28
Other Predictors							
13	Predicted Interest-Branch Fit	487	.54	.26	2,285	.36	.44
14	College Quality Index	1,191	.63	.84	2,828	.56	.84

Note. Predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 14. Predictor Composite Correlations

Predictor Composite	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Outcome Metric Score														
1 Academic Component Score		18,248	17,900	16,390	16,390	16,390	16,390	16,390	16,390	16,390	16,390	16,390	8,492	10,727
2 Leadership Component Score	**.37**		17,900	16,390	16,390	16,390	16,390	16,390	16,390	16,390	16,390	16,390	8,492	10,727
3 Physical Component Score	**.14**	**.41**		16,061	16,061	16,061	16,061	16,061	16,061	16,061	16,061	16,061	8,328	10,472
Cadet Background and Experience Form														
4 Achievement Composite	**.09**	**.18**	**.04**		17,810	17,810	17,810	17,810	17,810	17,810	17,810	17,810	8,719	11,126
5 Fit/Commitment Composite	-.01	**.14**	**.08**	**.83**		17,810	17,810	17,810	17,810	17,810	17,810	17,810	8,719	11,126
6 Response Distortion Composite	**-.04**	**-.04**	**-.02**	**.35**	**.30**		17,810	17,810	17,810	17,810	17,810	17,810	8,719	11,126
7 Peer Leadership Composite	**.04**	**.17**	**.02**	**.80**	**.49**	**.16**		17,810	17,810	17,810	17,810	17,810	8,719	11,126
8 Fitness Composite	**-.04**	**.23**	**.29**	**.62**	**.76**	**.05**	**.44**		17,810	17,810	17,810	17,810	8,719	11,126
9 Tolerance Composite	**.05**	**.09**	**.04**	**.70**	**.79**	**.56**	**.29**	**.48**		17,810	17,810	17,810	8,719	11,126
Work Values Inventory														
10 Profile Similarity Index (PSI)	.00	**.15**	**.11**	**.49**	**.64**	**.05**	**.31**	**.61**	**.56**		17,810	17,810	8,719	11,126
Leader Knowledge Test														
11 Characteristics Score	**.08**	**.03**	**-.02**	**.09**	**.13**	**-.04**	**-.04**	**.02**	**.24**	**.14**		17,810	8,719	11,126
12 Skills Score	**.11**	**.05**	.00	**.07**	**.09**	**-.14**	**-.03**	**.02**	**.18**	**.12**	**.72**		8,719	11,126
Other Predictors														
13 Predicted Interest-Branch Fit	**.04**	-.01	**-.04**	**-.03**	-.01	.00	-.01	-.02	-.01	.00	.00	.02		8,891
14 College Quality Index	**.05**	**.08**	**.11**	**-.06**	**-.08**	**-.14**	**-.03**	**.02**	**-.11**	.01	**-.02**	.01	**-.03**	

Note. Sample sizes appear above the diagonal. Bold = $p < .05$. Total Active Duty $n = 20,359$; smaller sample sizes are due to missingness on predictor measures.

Criterion Measures and Composites

We developed two instruments to: (a) quantify the in-unit performance of junior officers in their assigned branch; and (b) assess junior officer career expectations. The Junior Officer Performance Rating Scale (JOPRS) instrument was used to collect job performance ratings from supervisors. Captains rated the performance of their subordinate Lieutenants; Lieutenant Colonels and Majors rated the performance of their subordinate Captains. The JOPRS also contained items to assess (a) supervisor familiarity with the subordinate and (b) supervisor opportunity to observe behaviors related to junior officer performance. The Junior Officer Survey (JOS) is a self-report instrument that captures information about the officer's background, experiences, performance, attitudes, and career intentions. The JOPRS and JOS data were supplemented by using archival records.

We used a fishnet approach to collect the JOPRS and JOS data. The fishnet approach refers to the method of collecting criterion measures from all officers in a unit during a data collection effort, regardless of their commissioning source. By following this approach, we recognized that only some of the data would be collected for junior officers who were commissioned through ROTC and could be linked to the USACC archival records containing the pre-commissioning metrics and the ARI non-cognitive datasets. Using this approach, JOPRS data were collected for 2,284 junior officers and JOS data were collected from 4,347 junior officers.

Junior Officer Performance Rating Scale

The original JOPRS instrument included 14 items, which are presented in Table 15. The items are based on studies of officer duty requirements and are intended to cover a broad range of critical duties performed by officers. Supervisors were instructed to rate one or more subordinate officers. In doing so, they were asked to (a) consider the officer's typical performance over time, and (b), using the rating scale in Figure 2, indicate how well the officer performed relative to other officers with similar commissioned experience.

To reduce the demands on supervisors, the JOPRS instrument was shortened after the data collection period had begun. The shortened instrument contained 8 items, after removing items 2, 5, 8, 9, 10, and 13 (see Table 15). Approximately 55% of participants had ratings on the full, 14-item instrument, and the remainder had ratings on the reduced, 8-item instrument.

(1) Well Below Average	(2) Below Average	(3) Average	(4) Above Average	(5) Well Above Average	(6) Outstanding	(7) Truly Exceptional	Not Observed/ Cannot Rate
Bottom 10% of Peer Group	*Bottom 25% of Peer Group*	*Middle 50% of Peer Group*	*Top 25% of Peer Group*	*Top 10% of Peer Group*	*Top 5% of Peer Group*	*The Very Best Office in Peer Group*	

Figure 2. Performance rating scale.

Table 15. Junior Officer Performance Rating Scales (JOPRS)

Item	Text
1	Performs branch-specific technical and tactical duties proficiently.
2[a]	Performs core warrior tasks required of all personnel proficiently.
3	Communicates clearly and persuasively in writing.
4	Is effective in oral discourse; listens actively; speaks clearly and persuasively.
5[a]	Demonstrates effort and willingness to keep working under adverse conditions.
6	Demonstrates self-control and personal discipline on the job; provides leader presence and composure.
7	Maintains physical fitness, strength, and weight effectively.
8[a]	Fosters teamwork and enthusiasm for accomplishing objectives; supports and empowers subordinates.
9[a]	Provides structure, direction, training, and instruction to subordinates and informs them of things they should know.
10[a]	Makes sound decisions and adapts strategies to changing situations.
11	Plans, coordinates, staffs and monitors unit activities, using resources effectively to accomplish goals.
12	Represents the Army effectively in cross-cultural, multinational, or joint-forces settings.
13[a]	Performs day-to-day administrative tasks, keeping accurate records and reports.
14	Innovates solutions to problems.

[a] Item was later dropped from the JOPRS.

Junior Officer Survey

The JOS instrument contained five sections: Background Information, Education, Training and Branch Assignment History, Self-Reported Performance, and Career Intent and Attitudes. These sections contained 104 questions. Many of the items in the JOS were intended for sample description purposes (e.g., gender, initial branch assignment), but several items were linked to indicators of performance or career continuance (e.g., number of skill identifiers and career satisfaction). Figure 3 provides examples of JOS items used as criterion variables.

Education

- Which of the following best represents your major area of study as a college undergraduate?

Training and Branch Assignment History

- How many additional skill identifiers (ASI) do you have?

Self-Reported Performance

- Have you ever been formally counseled about your behavior or discipline (outside of routine counseling)?
- Have you ever been formally counseled about unsatisfactory performance?
- What was your latest Army Physical Fitness Test (APFT) test score?
- Has the senior officer or rater ever recommended you for command on the OER?
- As an officer, how many times have you been selected for below-the-zone promotion?

Career Intentions and Attitudes

- Which of the following best describes your current active duty career intentions?
- How many years, in total, do you plan to stay in the Army as an Active Duty Officer?
- What is the highest level at which you would like to command during your Active Army career?

Figure 3. Example Junior Officer Survey (JOS) items.

Archival Variables

We obtained archival records from several databases to broaden the scope of the criterion space. These sources include:

- Officer Master File (OMF) and Separation Officer Master File (SOMF) files. These files are maintained by the U.S. Army Human Resources Command and were provided to ARI on a quarterly basis. The OMF contains both demographic and performance data.
- Army Training Requirements and Resources System (ATRRS). This file is maintained by TRADOC and includes information about military coursework.

The archival data were used to form the following variables:

- *Basic Officer Leader Course – B (BOLC B) recycles.* The ATRRS database includes basic information on whether an officer recycled (i.e., had to repeat) a portion of the course at least once.
- *Total Awards.* OMF data provides information about awards. Officers can be awarded medals for many reasons, such as deploying (e.g., Afghanistan Campaign Medal), serving on active duty (e.g., National Defense Service Medal), and meritorious service (e.g., Army Commendation Medal). Prior research on awards variables concluded that only those awards for meritorious service and valor were sensible to include as criterion measures (Allen & Young, 2012). Accordingly, we constructed the awards variable by summing the meritorious and service/valor awards.
- *Retention.* OMF data were used to create retention scores based on officer separation code data. Appendix B, Retention Supplement, provides details on the retention measurement methodology and validation results.

Criterion Composites

Given the large number of criterion variables, we sought a way to meaningfully combine these metrics into broader performance and attitudinal composites. These composites were used as criteria to validate the pre-commissioning and non-cognitive metrics and provide input to the simulation models.

Performance Composites. A performance model developed in prior ARI research identified eight performance components present in all jobs (Campbell, 2012; Campbell & Knapp, 2001; Campbell et al., 1993). Table 16 lists the eight components.

To sort criterion items and scales into these performance components, we used a content-oriented approach that was informed by empirical analyses. Research psychologists from the project team made ratings to indicate how well each criterion item or scale fit into each component. Disagreements about ratings were resolved through discussion with a SME who had extensive experience with the Army. After making decisions based on content, we examined basic psychometric data for the variables. Based on these analyses, we dropped a few criterion items due to (a) low item-total correlations for the measure, (b) negative correlations between an item and other items linked to the same component, or (c) low base rates or missing data.

Table 16. Preliminary Performance Components

Dimension	Definition
1. Branch-Specific Technical Task Proficiency	The degree to which the officer performs the core substantive or technical tasks and duties that are central to his or her branch.
2. Army-Wide Technical Task Proficiency	The degree to which the officer performs the core substantive or technical tasks and duties that are Army-wide.
3. Written and Oral Communication Task Proficiency	The proficiency with which the officer can write or speak, independent of the correctness of the subject matter.
4. Demonstrating Effort	The consistency of an officer's effort day by day, the frequency with which he will expend extra time when required, and the willingness to keep working under adverse conditions. It is a reflection of the degree to which individuals commit themselves to all job tasks, work at a high level of intensity, and keep working when it is cold, wet, or late.
5. Maintaining Personal Discipline	The degree to which the officer avoids negative behaviors, such as alcohol and substance abuse at work, law or rules infractions, and excessive absenteeism.
6. Maintaining Physical Fitness, Strength, and Weight	The extent to which the officer meets or exceeds the Army's standards for fitness.
7. Leadership and Supervision	An officer's use of direct interpersonal interaction *to influence the behavior of other people* such that their performance is enhanced, both individually and collectively. Includes: encouraging, supporting, empowering, and training/coaching subordinates, influencing own supervisors, and serving as a role model.
8. Management and Administration	An officer's use of (i.e., management of) the unit's/Army's resources to achieve its goals. Includes: articulating goals for the unit, organizing people and resources, monitoring progress, controlling expenditures, and representing the unit in dealings with other units, organizations, or the public. Administration includes performing day-to-day administrative tasks, keeping accurate records, documenting actions, analyzing routine information, and making information available in a timely manner.

Note. From Russell, Paullin, Legree, Kilcullen, & Young (2017, p.19).

We then used CFA to compare the 8-component model to other potential substantive models and examine the extent of common method variance. We did not include the Branch Satisfaction, Career Ambition, Career Intentions, and retention status in the CFAs because they are not performance-related outcomes (i.e., these models were intended to model performance). During this process, several additional items were removed due to negative or near-zero factor loadings. Fit indices were compared for models with 1, 2, 3, 4, 5, 6, 7, and 8 performance factors, as well as models that included these performance factors plus two method factors for supervisory performance ratings, and self-report/archival factors). Common method variance, represented by the two method factors, fit the data better than those that did not. The best fitting model included the eight performance factors from our initial mapping plus two method factors (see Table 17).

Table 17. Confirmatory Factor Analyses (CFA) Results

Number of Performance Factors	Performance Components [a]	Method Factors [b]	Fit Indices			
			RMSEA	CFI	TLI	SRMR
1	1+2+3+4+5+6+7+8	No	0.06	0.84	0.83	0.14
3	1+2+3+8, 4+5+6, 7	No	0.06	0.85	0.83	0.14
4	1+2, 3+8, 4+6, 5+7	No	0.09	0.70	0.66	0.12
5	1+2, 3+8, 4, 5+7, 6	No	0.08	0.74	0.71	0.11
6	1+2, 3+8, 4, 5, 6, 7	No	0.06	0.88	0.86	0.13
6	1+2, 3, 4, 5+7, 6, 8	No	0.10	0.65	0.61	0.17
7	1+2, 3, 4, 5, 6, 7, 8	No	0.07	0.81	0.78	0.17
8	1, 2, 3, 4, 5, 6, 7, 8	No	0.06	0.83	0.80	0.17
1	1+2+3+4+5+6+7+8	Yes	0.05	0.92	0.91	0.05
3	1+2+3+8, 4+5+6, 7	Yes	0.05	0.93	0.91	0.06
4	1+2, 3+8, 4+6, 5+7	Yes	0.04	0.93	0.92	0.08
5	1+2, 3+8, 4, 5+7, 6	Yes	0.05	0.93	0.91	0.08
6	1+2, 3+8, 4, 5, 6, 7	Yes	0.03	0.96	0.95	0.08
6	1+2, 3, 4, 5+7, 6, 8	Yes	0.04	0.96	0.95	0.06
7	1+2, 3, 4, 5, 6, 7, 8	Yes	0.03	0.96	0.95	0.08
8	1, 2, 3, 4, 5, 6, 7, 8	Yes	0.03	0.97	0.96	0.07
2	Can-Do, Will-Do	Yes	0.04	0.95	0.93	0.06

Note. n = 3,151. RMSEA = Root Mean Square Error of Approximation; acceptable values are less than .08. CFI = Comparative Fit Index; acceptable values are greater than or equal to .95; TLI = Tucker-Lewis Index; acceptable values are greater than or equal to .95. SRMR = Standardized Root Mean-Square Residual; acceptable values are less than .08 (see Hu & Bentler, 1999, for rules for fit indices).
[a] See Table 16 for full titles and definitions of the performance components. A "+" indicates that performance dimensions were combined into one factor. [b] Indicates whether two method factors (supervisory performance ratings, self-report/archival) were included in the model.

To overcome the practical constraints associated with evaluating multiple criteria, we created an overall performance composite by aggregating the eight performance factors, described above. Specifically, we used importance weights for each of eight performance dimensions that were developed for an earlier project (Russell et al., 2017). In that study, SMEs rated the importance of seven performance components (components correspond to 1+2, 3, 4, 5, 6, 7, and 8 from the present study) for several officer positions (e.g., platoon leader, company commander, battalion commander). Because the weights among the platoon leaders and company commanders were very similar and most officers in the current research were Lieutenants, we used the mean importance ratings associated with the platoon leaders (see Table 18) to weight and aggregate the eight performance dimensions. This led to an overall performance composite that could be used as a single criterion.

For practical purposes, we wanted to use a single performance criterion variable (i.e., the Weighted 8-Factor Composite) in the validation analyses and for algorithm development. However, we also investigated a two-factor model that represented maximal (i.e., Can-do) and typical (i.e., Will-do) performance (e.g., Campbell, 1990; Cronbach, 1960). Other researchers have found that Can-do and Will-do performance have different predictors (e.g., Klehe & Latham, 2008), and the conceptual clarity of two factors (rather than eight) could increase interpretability of results. The Can-do and Will-do factors were developed using a combination of theoretical and empirical approaches; theory was used to guide the initial placement of items onto factors (e.g., Will-do items represent motivation-based features) and empirical correlations among items were used to make additional refinements. We also used the Can-do and Will-do factors as part of our overall validity research.

Table 18. Importance Ratings Used to Weight Elements of Overall Performance Composite

Criterion Dimension	Mean Importance Rating
1. Branch-Specific Technical Task Proficiency	5.91
2. Army-Wide Technical Task Proficiency	5.91
3. Written and Oral Communication Task Proficiency	4.18
4. Demonstrating Effort	6.32
5. Maintaining Personal Discipline	5.73
6. Maintaining Physical Fitness, Strength, and Weight	6.18
7. Leadership and Supervision	5.82
8. Management and Administration	4.73

Note. Ratings (from Russell, Paullin, Legree, Kilcullen, & Young, 2017) were made on a 7-point scale where 1 = Somewhat Important, 3 = Important, 5 = Very Important, and 7 = Extremely Important. SMEs rated Technical Task Proficiency (i.e., dimensions 1 and 2 combined), so the same weight was used for both dimensions.

Table 19 summarizes measures included in the final performance composites: the composites listed in rows 9-12 are the key performance measures used for the validation analyses (Chapter 3) and classification simulations (Chapter 4). Table A.6 in Appendix A shows the items and scales that loaded on each of the performance composites, as well as their factor loadings.

Table 19. Final Performance Scores and Composites

Performance Score		Measurement Summary
Eight Performance Dimension Scores		
1	Branch-Specific Technical Task Proficiency	Ratings of branch-specific performance; BOLC B performance; additional skill identifiers.
2	Army-Wide Technical Task Proficiency	Ratings of core warrior task performance; completion of special training (Ranger, Airborne).
3	Written and Oral Communication Task Proficiency	Ratings of written and oral communication performance.
4	Demonstrating Effort	Ratings of effortful performance and number of merit and valor awards
5	Maintaining Personal Discipline	Ratings of self-control/discipline; receiving formal counseling for poor performance or behavior.
6	Maintaining Physical Fitness, Strength, and Weight	Rating of physical fitness; latest Army Physical Fitness Test score.
7	Leadership and Supervision	Ratings on fostering teamwork, providing structure, and representing the Army; receiving key assignments or recommendations (e.g., for command, S3).
8	Management and Administration	Ratings of planning, decision-making, problem-solving, and administrative task performance.
Key Performance Composites		
9	Overall Performance: Weighted 8-Factor Composite	Importance-weighted average of all eight performance dimensions
10	Can-Do	Aspects of performance that are primarily a function of knowledge and skill.
11	Will-Do	Aspects of performance that are primarily a function of effort and motivation.
12	Mean Supervisor Rating	Mean supervisor rating across the reduced set of JOPRS scales.

Attitudinal Composites

Branch Satisfaction and Continuance Intention (i.e., Career Ambition and Career Intentions) composites were derived by computing a standardized average of JOS self-report items. Table 20 summarizes the content of these composites. Table A.7 in Appendix A shows the items and scales that were mapped onto the attitudinal composites.

Table 20. Final Attitudinal Composites

Attitudinal Composite	Measurement Summary
Satisfaction	
Branch Satisfaction	Rating of branch satisfaction; responses showing dissatisfaction with branch assignment.
Continuance Intentions	
Career Ambition	Responses showing a desire for promotion.
Career Intentions	Responses that indicate thinking about or planning to leave the Army before retirement; submitting a separation or resignation request.

Criterion Composite Descriptive Statistics

Tables 21-25 provide descriptive statistics and intercorrelations for the performance and attitudinal composites in the Validation Sample. Tables A.8 and A.9 in Appendix A provide subgroup differences on these composites.

Table 21 shows that differences between Lieutenants and Captains were moderate to large, with Captains earning higher scores on most performance composites than Lieutenants (particularly Leadership and Supervision and Demonstrating Effort). As before, differences by branch cluster are provided in Tables 22-24 (MF&E, OS, and FS, respectively).

Table 25 shows that Career Ambition and Career Intentions composites tended to have small, but often significant, correlations with performance composites. Correlations among the eight performance composites were generally medium to large, but some were near-zero or even negative. The pattern of correlations tended to support the conceptual distinction among the eight performance composites. For example, in terms of convergent validity, the two task proficiency composites, branch-specific and Army-wide, were highly correlated ($r = .75$), which is consistent with their similarity as task-focused performance. In contrast, the Management and Administration and Maintaining Personal Discipline composites were weakly correlated ($r = .17$), which is consistent with their conceptual distinctiveness.

Table 21. Descriptive Statistics for Performance and Attitudinal Criterion Composites Overall and by Rank

Criterion Composite		Overall n = 2,717			Lieutenants n = 1,725			Captains n = 983			
		N	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*d*
Performance Dimensions											
1	Branch-Specific Technical Task Proficiency	2,717	-.05	.74	1,725	-.30	.69	983	.38	.63	**1.01**
2	Army-Wide Technical Task Proficiency	2,717	-.01	.64	1,725	-.09	.63	983	.12	.64	**0.33**
3	Written and Oral Communication Task Proficiency	2,717	-.03	.57	1,725	-.15	.55	983	.19	.53	**0.62**
4	Demonstrating Effort	2,717	-.10	.98	1,725	-.47	.86	983	.56	.82	**1.22**
5	Maintaining Personal Discipline	2,717	.01	.76	1,725	.00	.75	983	.02	.77	0.02
6	Maintaining Physical Fitness, Strength, and Weight	2,717	.02	.69	1,725	.05	.68	983	-.04	.69	**-0.13**
7	Leadership and Supervision	2,717	-.08	.75	1,725	-.38	.67	983	.45	.57	**1.31**
8	Management and Administration	2,717	-.04	.56	1,725	-.21	.52	983	.25	.50	**0.89**
Key Performance Composites											
9	Overall Performance: Weighted 8-Factor Composite	2,717	-.04	.48	1,725	-.21	.44	983	.26	.40	**1.12**
10	Can-Do	2,717	-.03	.71	1,725	-.19	.66	983	.25	.71	**0.66**
11	Will-Do	2,717	-.05	.73	1,725	-.24	.70	983	.30	.65	**0.80**
12	Mean Supervisor Rating (Reduced JOPRS)	1,225	4.80	1.20	772	4.62	1.18	444	5.13	1.16	**0.44**
Satisfaction Composite											
13	Branch Satisfaction	2,425	1.60	.57	1,490	1.59	.58	935	1.60	.55	0.00
Continuance Intentions Composites											
14	Career Ambition	2,379	1.60	.52	1,460	1.57	.53	919	1.65	.50	**0.15**
15	Career Intentions	2,382	2.55	.86	1,463	2.53	.88	919	2.56	.83	0.04

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. *d* = Cohen's *d*; standardized mean difference between Lieutenant and Captain samples. Positive *d*-values indicate higher scores for Captains, and negative *d*-values indicate higher scores for Lieutenants. Bolded values indicate significant differences ($p < .05$). Some predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 22. Descriptive Statistics for Performance Criteria by Maneuver, Fires and Effects (MF&E) Clusters

Criterion Composite	Branch Cluster								
	Maneuver *n* = 525			Maneuver Support *n* = 385			Fires *n* = 271		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Performance Dimensions									
1 Branch-Specific Technical Task Proficiency	525	.04	.73	385	-.10	.77	271	-.05	.71
2 Army-Wide Technical Task Proficiency	525	.11	.64	385	-.04	.70	271	.03	.67
3 Written and Oral Communication Task Proficiency	525	-.04	.60	385	-.01	.58	271	-.05	.52
4 Demonstrating Effort	525	-.07	.96	385	-.21	.96	271	-.18	.88
5 Maintaining Personal Discipline	525	.02	.76	385	.03	.72	271	-.02	.81
6 Maintaining Physical Fitness, Strength, and Weight	525	.08	.60	385	.02	.71	271	.02	.66
7 Leadership and Supervision	525	-.05	.73	385	-.13	.75	271	-.11	.74
8 Management and Administration	525	-.04	.55	385	-.05	.56	271	-.05	.61
Key Performance Composites									
9 Performance Composite: Weighted 8-Factor Composite	525	-.01	.47	385	-.07	.49	271	-.07	.45
10 Can-Do	525	.28	.75	385	-.09	.68	271	.04	.67
11 Will-Do	525	.13	.73	385	-.06	.70	271	-.07	.73
12 Mean Supervisor Rating (Reduced JOPRS)	253	4.84	1.20	186	4.71	1.20	116	4.78	1.18
Satisfaction Composite									
13 Branch Satisfaction	443	1.73	.64	352	1.52	.49	253	1.47	.52
Continuance Intentions Composites									
14 Career Ambition	430	1.62	.53	349	1.61	.53	252	1.65	.54
15 Career Intentions	432	2.58	.84	349	2.51	.83	252	2.55	.91

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. Some predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 23. Descriptive Statistics for Performance Criteria by Operations Support (OS) Clusters

		Branch Cluster					
		Intelligence, Reconnaissance, and Surveillance *n* = 318			Network & Space Operations *n* = 204		
Criterion Composite		*n*	*M*	*SD*	*n*	*M*	*SD*
Performance Dimensions							
1	Branch-Specific Technical Task Proficiency	318	-.05	.78	204	-.16	.70
2	Army-Wide Technical Task Proficiency	318	-.04	.56	204	-.05	.62
3	Written and Oral Communication Task Proficiency	318	-.01	.64	204	-.06	.51
4	Demonstrating Effort	318	-.03	1.10	204	-.24	.94
5	Maintaining Personal Discipline	318	.01	.74	204	-.12	.90
6	Maintaining Physical Fitness, Strength, and Weight	318	.04	.71	204	-.02	.74
7	Leadership and Supervision	318	-.07	.77	204	-.16	.72
8	Management and Administration	318	-.03	.58	204	-.10	.59
Key Performance Composites							
9	Overall Performance: Weighted 8-Factor Composite	318	-.02	.53	204	-.13	.46
10	Can-Do	318	-.04	.70	204	-.14	.68
11	Will-Do	318	-.09	.73	204	-.11	.66
12	Mean Supervisor Rating (Reduced JOPRS)	145	4.57	1.18	98	4.79	1.21
Satisfaction Composite							
13	Branch Satisfaction	264	1.64	.56	172	1.62	.62
Continuance Intentions Composites							
14	Career Ambition	257	1.57	.52	167	1.62	.53
15	Career Intentions	257	2.46	.82	168	2.59	.80

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. Some predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 24. Descriptive Statistics for Performance Criteria by Force Sustainment (FS) Clusters

Criterion Composite		Branch Cluster					
		Health Services *n* = 309			Integrated Logistics Corps/Soldier Support *n* = 646		
		n	*M*	*SD*	*n*	*M*	*SD*
Performance Dimensions							
1	Branch-Specific Technical Task Proficiency	309	-.12	.74	646	-.05	.73
2	Army-Wide Technical Task Proficiency	309	-.11	.55	646	-.04	.67
3	Written and Oral Communication Task Proficiency	309	-.03	.50	646	-.03	.57
4	Demonstrating Effort	309	-.01	1.02	646	-.07	.97
5	Maintaining Personal Discipline	309	.07	.62	646	.00	.79
6	Maintaining Physical Fitness, Strength, and Weight	309	-.03	.71	646	-.01	.72
7	Leadership and Supervision	309	-.12	.82	646	-.02	.73
8	Management and Administration	309	-.05	.54	646	-.02	.55
Key Performance Composites							
9	Overall Performance: Weighted 8-Factor Composite	309	-.04	.49	646	-.03	.48
10	Can-Do	309	-.31	.67	646	-.13	.65
11	Will-Do	309	-.26	.80	646	-.03	.71
12	Mean Supervisor Rating (Reduced JOPRS)	105	5.24	1.03	293	4.79	1.21
Satisfaction Composite							
13	Branch Satisfaction	293	1.79	.56	600	1.47	.51
Continuance Intentions Composites							
14	Career Ambition	285	1.66	.51	593	1.56	.52
15	Career Intentions	285	2.74	.80	593	2.47	.92

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. Some predictor sample sizes are smaller than total sample sizes due to missing data on the predictor measures of interest.

Table 25. Correlations among Performance and Attitudinal Criterion Composites

Criterion Composite	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Performance Dimensions															
1 Branch-Specific Technical Task Proficiency		2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
2 Army-Wide Technical Task Proficiency	**.75**		2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
3 Written and Oral Communication Task Proficiency	**.42**	**.05**		2,717	2,717	2,717	2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
4 Demonstrating Effort	**.76**	**.32**	**.37**		2,717	2,717	2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
5 Maintaining Personal Discipline	**.31**	**.20**	**.07**	**.07**		2,717	2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
6 Maintaining Physical Fitness, Strength, and Weight	**.28**	**.45**	**-.26**	.03	**.21**		2,717	2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
7 Leadership and Supervision	**.80**	**.31**	**.45**	**.77**	**.06**	.02		2,717	2,717	2,717	2,717	1,225	2,425	2,379	2,382
8 Management and Administration	**.54**	-.03	**.52**	**.57**	**.17**	**-.36**	**.71**		2,717	2,717	2,717	1,225	2,425	2,379	2,382
Key Performance Composites															
9 Overall Performance: Weighted 8-Factor Composite	**.93**	**.50**	**.48**	**.83**	**.42**	**.27**	**.85**	**.65**		2,717	2,717	1,225	2,425	2,379	2,382
10 Can-Do	**.64**	**.61**	**.15**	**.33**	**.10**	**.24**	**.52**	**.25**	**.51**		2,717	1,225	2,425	2,379	2,382
11 Will-Do	**.57**	**.31**	**.22**	**.36**	**.07**	**.13**	**.77**	**.42**	**.57**	**.72**		1,225	2,425	2,379	2,382
12 Mean Supervisor Rating (Reduced JOPRS)	**.39**	**.16**	**.24**	**.28**	**.19**	**.15**	**.35**	**.28**	**.44**	**.27**	**.35**		933	923	923
Satisfaction Composite															
13 Branch Satisfaction	.01	.00	.00	-.01	**.06**	**-.04**	-.01	.03	.01	.02	.02	**.09**		2,379	2,382
Continuance Intentions Composites															
14 Career Ambition	**.15**	**.07**	**.05**	**.11**	.02	.02	**.18**	**.13**	**.15**	**.12**	**.17**	**.19**	**.20**		2,379
15 Career Intentions	**.11**	**.05**	.03	**.10**	**.06**	.00	**.11**	**.10**	**.11**	**.07**	**.09**	**.18**	**.32**	**.74**	

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Sample sizes appear above the diagonal. Bold = $p < .05$. Total Validation Sample n = 2,717; smaller sample sizes are due to missingness on predictor measures.

CHAPTER 3: VALIDATION APPROACH AND RESULTS

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The focus of this chapter is twofold. First, we describe the validation approach used to evaluate the prediction of multiple *performance* criteria. Secondly, we present results of the analyses. We detail results for the Validation Sample (overall, and by functional categories/branch clusters) using bivariate correlations, hierarchical multiple regressions, and Bayesian Model Averaging (BMA) procedures. We also used the Validation and Active Duty Samples to evaluate prediction of the *retention* and *branch satisfaction* criteria. Appendix B details retention analysis results and Appendix C details branch satisfaction and rank results.

Validation Analyses Approach

Validation analyses examined the relationships of the predictor composites (see Table 9), with the performance, attitudinal, and continuance criterion composites. Analyses using the performance and attitudinal criteria were conducted using the Validation Sample. Analyses using the military retention criterion were conducted using the Active Duty Sample (i.e., those cadets who became commissioned officers and were assigned to the U.S. Army Active Duty component). For the validation (Chapter 3) and classification simulation (Chapter 4) results, we excluded direct commission branches and the Logistics branch from analyses (Officers are only branched into Logistics after promotion to Captain and completion of the Logistics Captains Career Course). This resulted in a reduction of the Validation Sample by n = 134 for the Health Services branch cluster (removing Nurse, Medical, Medical Specialist, and Veterinary Corps branches) and reduction of n = 69 for the Integrated Logistics Corps/Soldier Support branch cluster (removing Logistics branch); no other branch clusters were affected.

Validation analyses had two overarching purposes: (a) explore predictors of relevant criteria using overall and by rank analyses, and (b) support the branching algorithm using the branch cluster results. To support the first purpose, we used three performance criteria: Weighted 8-Factor, Can-do, and Will-do performance composites. For the branch cluster validity analyses and to provide input for the branching simulation, we conducted analysis using only the Weighted 8-Factor Composite. We choose to focus the branch analyses on the Weighted 8-Factor Composite because of practical constraints arising from the use of multiple criteria to inform classification decisions. The Weighted 8-Factor Composite was also chosen because it is the most comprehensive of the performance composites. This choice had empirical support. The Can-do and Will-do composites correlated .72 and their correlations with the Weighted 8-Factor Composite were over .51 as shown in Table 25.

As described in Chapter 3, we also computed predicted performance scores for the three criterion composites based on predictor-criterion relationships. The predicted performance scores for Can-do, Will-do, and Weighted 8-Factor constructs were highly correlated (all $r > .84$). This result also supported our use of the more global measure (i.e., the Weighted 8-Factor performance composite) in the branch analyses because the choice of performance composite would have only minimal impact on classification decisions and potential gains.

Our first step was to compute bivariate correlations between predictor and criterion scores. Next, we conducted hierarchical multiple regression to evaluate the incremental validity of the non-cognitive predictors over and above the validity of operational Cadet OMS components. In turn, we conducted Bayesian Model Averaging (BMA) to determine the relative importance of all predictors in the full model. Ordinary least squares (OLS) multiple regression was used for the continuous criteria in the Validation Sample. We conducted three general groups of analyses: (a) for the overall samples, (b) by rank (Lieutenant versus Captain), and (c) by branch cluster.

Bivariate Correlations

For bivariate correlations, we used a pairwise deletion approach that allowed us to retain all useable cases for each correlation. In the Validation Sample, the outcomes of interest were (a) the Weighted 8-Factor Composite, (b) branch satisfaction, and (c) branch-specific technical task proficiency as well as (d) self- and supervisory-performance ratings. We used a wide set of criteria in the correlational analyses and a smaller, more focused set of criteria for the regression-based analyses.

Regression Analyses

Regression analyses were conducted to evaluate two research questions. First, we used hierarchical multiple regression to address the first question: To what extent do non-cognitive predictors contribute beyond the existing Cadet OMS components in predicting criteria of interest? BMA was used to address the second, twofold, question: (a) To what extent does the full predictor battery predict validation criteria, and (b) Which predictors are most important for predicting these criteria?

Each regression model contained complete cases for all predictors and criterion of interest (i.e., listwise deletion was used for all regression analyses). To adjust model estimates of validity for shrinkage, we used Burket's *R* (cf. Schmitt & Ployhart, 1999), calculated by:

$$\rho_c = \frac{nR^2 - k}{R(n-k)}$$

Where ρ_c is the estimated population cross-validity (i.e., shrinkage-adjusted *R*), *R* is the observed multiple correlation, *k* is the number of predictors in the model, and *n* is the sample size.

Hierarchical Multiple Regression

Hierarchical multiple regression was conducted to evaluate the extent to which the non-cognitive predictors contribute to prediction beyond the Cadet OMS components operationally used in officer classification. The baseline model included the three Cadet OMS components (Academic, Leadership, and Physical) and the covariate, College Quality Index. The full models included these baseline predictors, with the addition of six CBEF composites, two LKT scores, Predicted Interest-Branch Fit, the WVI – PSI, and the College Quality Index.

Bayesian Model Averaging

Bayesian Model Averaging is a regression-based approach for determining the relative importance of each predictor based on the uncertainty associated with identifying a single best regression model (Raftery, 1995). The goal of these analyses was to find the optimal weights for the predictor variables that predict the most variance in the dependent variables (criteria). Using BMA, a regression model for every possible combination of the predictors is estimated. This method computes the probability of being the "best" for the population given that the available data is estimated for each model. Regression coefficients are estimated by weighting the coefficients for a single model by the model probability and then averaging across all the models.

To evaluate the importance of each predictor to the overall best model, we examined the *predictor criticality* across all the models. A predictor criticality value of 100% for any given predictor indicates it was included in all plausible models (i.e., greater than 0% probability); and therefore, is a critical predictor of the focal criterion (Viallefont et al., 2001). We used the AIC during the model averaging process because AIC tends to give larger weights to more predictors than the Bayesian information criterion (BIC), allowing for increased utilization of information from a greater number of predictors. Furthermore, we used a corrected version of AIC (AICc), which adjusts for small sample size to decrease the likelihood that the AIC metric will overfit (Hurvich & Tsai, 1989).

Next, we estimated the optimized validity coefficient by computing the predictor composite score using the BMA regression equation, and then regressed the criterion onto the predictor composite score. In other words, we applied BMA regression weights to predictor scores to generated model-predicted criterion scores. We then correlated model-predicted criterion scores with the observed criterion scores (i.e., Multiple *R*'s) to evaluate overall prediction from the BMA analyses. We included all predictors in the BMA predictor composite scores regardless of the size of the regression coefficient. For a more detailed discussion of the BMA procedure utilized, refer to Russell et al. (2017).

Joint Predictor-Criterion Space Equivalence

Researchers have discussed the joint predictor-criterion space as the portion of the predictor-criterion space relevant to the classification decision and have highlighted that performance criteria may be equivalent in terms of predictor-criterion relationships (Scholarios, Zeidner & Johnson, 1994; Zeidner, Johnson & Scholarios, 2003). Therefore, we adapted this approach and correlated predicted scores between the key performance criteria to evaluate the level of equivalence of the joint predictor-criterion space. We were especially focused on the joint predictor-criterion space equivalence derived using the four principal performance composites (i.e., the Weighted 8-Factor, Can-do, and Will-do, and Mean Supervisor Rating criteria).

Results

Bivariate Correlations

Table 26 presents the predictor by criterion correlations for the Validation Sample. The strongest predictors of overall performance (Weighted 8-Factor Composite) were the Leadership (*r* = .22) and Academic (*r* = .13) OMS components and CBEF Peer Leadership (*r* = .12). Appendices B and C present (a) Weighted 8-Factor, Can-do and Will-do correlations by rank (Table C.1); and (b) predictor correlations with branch satisfaction by rank, and by branch cluster (Table C.2), and retention correlations (Table B.3).

Inspection of Table 26 suggests that the correlations of the 14 predictor composites with the four key performance composites followed highly similar patterns. For example, the pattern of the vector of the 14 correlations between the predictor composites and the Weighted 8-Factor Composite was very similar to the vector of the 14 correlations between the predictor composites and the Mean Supervisor Rating composite; in fact, the correlation between these two vectors was very high (*r* = .84; See Table 27). More generally, the correlations among the validity vectors computed for each the four key performance criteria were consistently high (*r* ranging from .72 to 89). Likewise, the correlations among the vectors computed for the three non-performance criteria were consistently high (*r* ranging from .72 to .98).

However, the correlations of the vectors between the four performance and the three non-performance attitudinal criteria were much lower (*r* ranging from .02 to .48, Median *r* = .24). The final row of Table 27 reports results for the vector developed to predict retention using separation code data collected for the Active Duty sample (See Appendix B, Table B.3). The retention vector was most highly correlated with the three non-performance attitudinal vectors (*r* ranging from .58 to .83) and only moderately correlated with the four key performance vectors (*r* ranging from .07 to .49). These results suggest that although predictors behave similarly within the performance and the non-performance criteria, they behave much differently across these broad classes of criteria (i.e., performance versus non-performance).

As described in Chapter 1, we grouped branches into clusters to ensure sufficient sample sizes for the regression analyses. Table 28 presents the predictor–criterion correlation matrices for the Validation Sample by branch cluster, for overall performance. As expected, differential patterns of predictor–performance correlations were found across the different branch clusters. For example, although the Leadership OMS component was a significant positive predictor of performance across all branch clusters (except for the Fires cluster), the magnitude of its effects varied substantially by branch cluster from .37 in the Intelligence, Surveillance, & Reconnaissance (ISR) cluster to .14 in the Maneuver cluster. Relatedly, several other predictors displayed differential patterns of prediction depending on branch cluster.

Table 26. Bivariate Validity Correlations: Validation Sample

		Predictor													
		Cadet Outcome Metric Score (OMS)			Cadet Background & Experience Form (CBEF)						WVI	Leader Knowledge Test (LKT)		Other	
	Criterion Composite	ACS	LCS	PCS	AC	FC	RD	PL	F	T	PSI	CH	SK	FIT	CQI
	Performance Dimensions														
1	Branch-Specific Technical Proficiency	**.12**	**.23**	**.12**	**.10**	**.09**	-.04	**.11**	**.12**	.01	**.06**	.02	.00	.02	**-.06**
2	Army-Wide Technical Proficiency	**.07**	**.20**	**.19**	**.06**	**.08**	-.04	**.07**	**.16**	.01	**.07**	-.02	-.03	.01	-.03
3	Written and Oral Communication	**.08**	**.07**	**-.08**	**.06**	.02	**-.06**	**.08**	-.02	-.02	.01	**.05**	**.04**	-.04	**.06**
4	Demonstrating Effort	**.11**	**.11**	-.01	.03	.01	-.01	.04	.00	-.02	.01	.02	.01	**.05**	**-.10**
5	Maintaining Personal Discipline	**.07**	**.14**	**.05**	**.09**	**.08**	.03	**.08**	**.08**	**.08**	**.04**	**.06**	.04	.03	-.02
6	Maintaining Physical Fitness, Strength, and Weight	**.06**	**.24**	**.45**	**.07**	**.09**	**.05**	**.05**	**.21**	**.07**	**.08**	-.01	-.03	-.03	.00
7	Leadership and Supervision	**.07**	**.10**	-.01	**.10**	**.06**	-.03	**.12**	**.05**	-.02	.02	.01	.00	.02	**-.07**
8	Management and Administration	**.07**	**.06**	**-.13**	**.06**	.02	**-.04**	**.08**	-.03	-.02	.00	.03	.04	.03	-.03
	Key Performance Composites														
9	Weighted 8-Factor	**.13**	**.22**	**.11**	**.11**	**.08**	-.01	**.12**	**.10**	.02	**.05**	**.04**	.02	.02	**-.06**
10	Can-do	**.06**	**.27**	**.19**	**.09**	**.11**	**-.07**	**.11**	**.23**	.00	**.10**	-.03	-.03	.02	-.01
11	Will-do	**.04**	**.17**	**.09**	**.14**	**.13**	-.04	**.15**	**.17**	.02	**.07**	-.01	-.02	-.01	-.03
12	Mean Supervisor Rating (Reduced JOPRS)	**.17**	**.28**	**.17**	**.14**	**.09**	.01	**.14**	**.09**	**.07**	**.08**	.01	.02	**-.07**	.05
	Satisfaction Composite														
13	Branch Satisfaction	**.08**	**.07**	-.02	**.08**	**.09**	.03	**.05**	.03	**.09**	**.05**	.02	.02	.00	-.01
	Continuance Intentions Composites														
14	Career Ambition	-.01	.03	**-.06**	**.22**	**.22**	**.10**	**.18**	**.10**	**.17**	**.07**	.03	.01	.03	**-.16**
15	Career Intentions	.00	.03	**-.06**	**.22**	**.25**	**.13**	**.15**	**.10**	**.24**	**.10**	**.06**	.03	.01	**-.20**

Note. Sample *n* = 643–2,513. ACS = Academic Component Score. LCS = Leadership Component Score. PCS = Physical Component Score. AC = Achievement. FC = Fit/Commitment. RD = Response Distortion. PL = Peer Leadership. F = Fitness. T = Tolerance. WVI PSI = Work Values Inventory – Profile Similarity Index. CH = Characteristics. SK = Skills. FIT = Predicted Interest-Branch Fit. CQI = College Quality Index. Bolded values indicate statistical significance ($p < .05$).

Table 27. Similarity of Predictor Validity Vectors for Performance and Non-performance Criteria

		Supervisor Ratings								Key Performance Composites				Non-Performance Criteria		
		BP	AT	W/OC	DE	PD	PF	LS	MA	W8	CD	WD	MSR	BS	CA	CI
Supervisor Ratings																
1	Branch-Specific Technical Proficiency	1.00	.90	.25	.71	.84	.62	.80	.26	.99	.90	.87	.84	.40	.23	.17
2	Army-wide Technical Proficiency	.90	1.00	-.07	.41	.64	.86	.53	-.15	.83	.98	.83	.78	.14	.06	.01
3	Written and Oral Communication	.25	-.07	1.00	.34	.28	-.40	.51	.80	.30	.04	.22	.37	.41	.02	-.04
4	Demonstrating Effort	.71	.41	.34	1.00	.69	.08	.76	.64	.78	.38	.39	.46	.46	.22	.20
5	Maintaining Personal Discipline	.84	.64	.28	.69	1.00	.37	.79	.42	.87	.64	.76	.69	.68	.56	.55
6	Maintaining Physical Fitness	.62	.86	-.40	.08	.37	1.00	.12	-.58	.56	.76	.55	.64	-.12	-.11	-.11
7	Leadership and Supervision	.80	.53	.51	.76	.79	.12	1.00	.68	.84	.58	.79	.58	.58	.56	.45
8	Management and Administration	.26	-.15	.80	.64	.42	-.58	.68	1.00	.34	-.05	.19	.13	.55	.35	.28
Key Performance Composites																
9	Weighted 8-Factor	.99	.83	.30	.78	.87	.56	.84	.34	1.00	.82	.82	.84	.44	.27	.21
10	Can-do	.90	.98	.04	.38	.64	.76	.58	-.05	.82	1.00	.89	.76	.16	.10	.03
11	Will-do	.87	.83	.22	.39	.76	.55	.79	.19	.82	.89	1.00	.72	.43	.48	.38
12	Mean Supervisor Rating	.84	.78	.37	.46	.69	.64	.58	.13	.84	.76	.72	1.00	.42	.06	.02
Non-performance/Attitudinal Criteria																
13	Branch Satisfaction	.40	.14	.41	.46	.68	-.12	.58	.55	.44	.16	.43	.42	1.00	.72	.74
14	Career Ambition	.23	.06	.02	.22	.56	-.11	.56	.35	.27	.10	.48	.06	.72	1.00	.98
15	Career Intent	.17	.01	-.04	.20	.55	-.11	.45	.28	.21	.03	.38	.02	.74	.98	1.00
16	Retention [a]	.10	.13	-.10	-.22	.38	.06	.25	-.01	.07	.20	.49	.08	.58	.83	.82

Note. BP = Branch-specific Proficiency, AT = Army Technical Proficiency, W/OC = Written and Oral Communication, DE = Demonstrating Effort, PD = Personal Discipline, PF = Physical Fitness, LS = Leadership and Supervision, MA = Management Administration, W8 = Weighted 8-Factor, CD = Can-do, WD= Will-do, MSR=Mean Supervisor Rating, BS = Branch Satisfaction, CA = Career Ambition, CI = Career Intent.

[a] Retention was based on separation codes.

Table 28. Bivariate Validity Correlations: Overall Performance Criterion (Weighted 8-Factor Composite) by Functional Category and Branch Cluster

	Predictor														
	Cadet Outcome Metric Score (OMS)			Cadet Background & Experience Form (CBEF)						WVI	Leader Knowledge Test (LKT)		Other	
Criterion: Weighted 8-Factor Composite	ACS	LCS	PCS	AC	FC	RD	PL	F	T	PSI	CH	SK	FIT	CQI
Maneuver, Fires, & Effects														
Maneuver	.06	**.14**	.05	.02	.01	**-.11**	.02	.03	-.02	.02	.03	.03	.01	-.03
Maneuver Support	**.15**	**.18**	**.17**	**.13**	**.10**	.03	**.12**	**.15**	.06	.08	.01	.00	.02	.02
Fires	.05	.00	.05	.05	.06	-.07	.07	.03	-.06	.01	.03	.10	-.01	.03
Operations Support														
Intelligence, Surveillance, & Reconnaissance (ISR)	**.16**	**.37**	**.14**	**.15**	.08	.00	**.21**	**.13**	-.03	.06	.08	.03	-.05	**-.19**
Network and Space Operations	.05	**.20**	-.01	**.16**	**.15**	.04	**.15**	**.15**	.06	.00	.02	-.10	-.02	-.05
Force Sustainment														
Health Services	**.31**	**.28**	.09	**.17**	.08	.00	**.17**	.05	.10	.02	.09	.13	**-.25**	**-.25**
Integrated Logistics Corps / Soldier Support	**.10**	**.19**	**.10**	**.12**	.09	.03	**.11**	**.08**	.03	.05	.01	-.06	.08	-.06

Note. Validation Sample, 643–2,513; Maneuver, 236–525; Infantry Branch,134–280; Maneuver Support, 213–385; Fires, 131–271; ISR, 159–318; Network and Space Operations, 108–204; Health Services, 77–175; Integrated Logistics Corps & Soldier Support, 315–577. ACS = Academic Component Score. LCS = Leadership Component Score. PCS = Physical Component Score. AC = Achievement. FC = Fit/Commitment. RD = Response Distortion. PL = Peer Leadership. F = Fitness. T = Tolerance. WVI PSI = Work Values Inventory – Profile Similarity Index. CH = Characteristics. SK = Skills. FIT = Predicted Interest-Branch Fit. CQI = College Quality Index. Bolded values indicate statistical significance ($p < .05$).

Hierarchical Multiple Regression Analyses

Table 29 presents the results of hierarchical OLS regression for the overall Validation Sample. Results indicate that the contribution of the non-cognitive predictors appreciably increased prediction of performance criteria beyond Cadet OMS Score. For the three performance criteria (Weighted 8-Factor, Can-do, Will-do), delta *R*'s, which quantify the adjusted increase in incremental validity, ranged from .041 to .081. Overall, CBEF components showed statistically significant and practically important incremental validity above and beyond the Cadet OMS scores currently used by the Army. This pattern of results also held across Lieutenant and Captain samples. For further details of results by rank, as well as incremental validity analyses for branch satisfaction, see Table C.3, Appendix C.

Table 29. Incremental Validity of New Predictors for the Overall Sample

Criterion		Cadet Outcome Metric Score (OMS) Only			Cadet OMS + New Predictors				
	n	*df*	*R*	*Adj. R*	*df*	*R*	*Adj. R*	Δ*R*	Δ *Adj. R*
Weighted 8-Factor Performance	1,940	4	.259	.251	14	.300	.278	.041**	.027
Can-do Composite	1,940	4	.304	.298	14	.364	.347	.060**	.049
Will-do Composite	1,940	4	.191	.180	14	.272	.247	.081**	.067

Note. Adjusted *R* reflects a Burket adjustment for shrinkage. $*p < .05$. $**p < .01$. Cadet OMS Only includes the three OMS scores (Academic, Leadership, and Physical) and the covariate College Quality Index. New Predictors includes the six CBEF composites, two LKT scores, Predicted Interest-Branch Fit, and the WVI – Profile Similarity Index.

Bayesian Model Averaging Results

Table 30 presents results of regression analyses for the Weighted 8-Factor, Can-do and Will-do performance composites using the OLS BMA approaches. The table also includes the model-averaged regression coefficient for each predictor and its criticality value (i.e., its cumulative importance across models). For many predictors, unstandardized regression coefficients (not shown) resembled averaged coefficients produced using the BMA approach. Because BMA estimates reflect more stable estimates of relationships between predictors and criteria, the similarities between coefficients across models is encouraging. Furthermore, any differences between these estimates (i.e., when the beta estimate is larger for the full model) are likely the result of the model having a low probability of being the best model. For full output of unstandardized and standardized regression coefficients for all samples, see Tables C.4-C.13, Appendix C.

Results of regression analyses for the Weighted 8-Factor, Can-do and Will-do performance composites were comparable. Predictor criticality (PC) values indicated that the Leadership OMS component was the most likely predictor to be included in the best model for all three performance criteria (PC =100% for all three). Thus, Leadership OMS was central to prediction of all focal outcomes. Another predictor that displayed high criticality values across all three performance composites was CBEF Tolerance (PC = 95% – 100%). Additionally, CBEF Fitness displayed a high criticality value (PC = 100%) on the Can-do performance composite.

Table 30. Validation OLS Bayesian Model Averaging Results for Predicting Performance in the Validation Sample

	Criterion Composite					
	Weighted 8-Factor n = 1,940		Can-do n = 1,940		Will-do n = 1,940	
Predictor	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept	-.116		-.153		-.109	
Outcome Metric Score						
Academic	.033	92%	-.002	28%	.000	27%
Leadership	.104	**100%**	.196	**100%**	.133	**100%**
Physical	.031	88%	.052	92%	.006	35%
Cadet Background & Experience Form						
Achievement	.032	59%	-.016	38%	.005	36%
Fit/Commitment	.091	97%	.013	35%	.162	**97%**
Response Distortion	.012	53%	-.008	37%	-.003	29%
Peer Leadership	.018	59%	.021	51%	.057	88%
Fitness	-.003	30%	.195	**100%**	.045	67%
Tolerance	-.121	**100%**	-.109	95%	-.164	**100%**
Work Values Inventory						
WVI – Profile Similarity	.001	28%	-.004	29%	-.006	31%
Leader Knowledge Test						
Characteristics	.016	39%	-.018	35%	-.006	28%
Skills	.006	31%	.000	28%	.003	27%
Other						
Predicted Interest – Branch Fit	.011	39%	.044	64%	.000	27%
College Quality Index	-.050	**100%**	-.052	**97%**	-.047	93%

Note. $\bar{b}$ = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion (e.g., top three predictors for the Weighted 8-Factor criterion were OMS Leadership, CBEF Tolerance, and College Quality Index). Linear multiple regression analyses were conducted using the Validation Sample.

Interestingly, the College Quality Index was also focal to the prediction of the three performance composites (PC = 93% – 100%). However, the College Quality Index displayed a negative regression coefficient for all three criteria, thereby associating higher college quality scores with lower performance scores. We ran the three regressions in Table 30 excluding the College Quality Index and the same pattern of results emerged, with regression coefficients correlated r = .99 when College Quality was included versus excluded. We chose to retain the College Quality Index in the final regression models because including it (a) had a positive impact on overall prediction and (b) it decreased subgroup differences on predicted scores. Results of BMA analyses by rank are found in Table C.14 (Lieutenants) and Table C.15 (Captains).

Joint Predictor-Criterion Space

To examine joint predictor-criterion space equivalence (cf. Scholaris et al., 1997; Zeidner et al., 2003), we calculated the correlations between predicted performance scores for each of the three regression models presented in Table 30. As seen in Table 31, predicted performance scores were very highly correlated across the three models: Weighted 8-Factor vs. Will-do, $r = .89$, $p < .001$; Weighted 8-Factor vs. Can-do, $r = .84$, $p < .001$; and Will-do vs. Can-do, $r = .90$, $p < .001$. Substantial correlations were also observed among the predicted scores for the non-performance attitudinal criteria (r ranged from .56 to .97, all $p < .001$). In contrast, much lower correlations were obtained by comparing predicted scores for the performance composites with predicted scores for the non-performance/attitudinal composites (e.g., predicted Weighted 8-Factor performance scores and predicted Career Intent scores were only modestly correlated, $r = .36$). Therefore, a high degree of differentiation is shown between the performance and non-performance criteria, despite results using separate performance criteria approaching redundancy. These results are critical because they indicate that potential gains in officer performance through better personnel classification are likely to transcend the specific performance composite being optimized and will therefore represent general gains in officer performance.

Table 31. Joint Predictor-Criterion Space Equivalence

	Performance Criterion Composite				Non-performance Criterion Composite			
Predicted Composite	Weighted 8-Factor	Can-Do	Will-Do	Reduced JOPRS	Branch Satisfaction	Career Intention	Career Ambition	Retention
Predicted Performance Criterion Composite								
Weighted 8-Factor		1940	1940	841	1772	1744	1741	1936
Can-do	.84		1940	841	1772	1744	1741	1936
Will-do	.89	.90		841	1772	1744	1741	1936
Reduced JOPRS	.83	.76	.74		673	663	663	840
Predicted Non-Performance Criterion Composite								
Branch Satisfaction	.42	.21	.34	.48		1744	1741	1768
Career Intention	.36	.16	.43	.13	.61		1741	1740
Career Ambition	.46	.26	.56	.17	.56	.97		1737
Retention	-.01^{ns}	.17	.11	-.04^{ns}	-.13	.23	.19	

Note. Correlations among predicted scores for disparate criteria using common predictor composites are in the lower, left triangle and corresponding sample sizes in are in the upper, right triangle.
^{ns} Non-significant with $p > .05$. All other correlations significant at $p < .001$.

In addition, correlations following a similar pattern were found when examining predicted performance scores within branch cluster. Therefore, overall regression-based relationships are very similar within each of the focal performance criteria, despite the antecedents of individual performance criteria differing across the performance and non-performance criteria.

BMA Branch Analyses

Tables 32-34 provide BMA regression coefficients and predictor criticality values for predicting performance by branch clusters within functional categories (MF&E, OS, and FS, respectively). The officer classification simulation described in Chapter 4 used these regression coefficients as inputs to (a) specify predictor-criterion relationships and (b) generate predicted performance scores for cadets. The Leadership OMS component was a critical predictor of performance for most branch clusters. CBEF Fit/Commitment and Tolerance Composites and the two LKT scores had high predictor criticality values for some, but not all, branch clusters. Therefore, these predictors may provide some differential prediction across branches. For example, LKT Skills was a top predictor for four (i.e., Fires, Network Operations, Health Services, and Integrated Logistics Corps/Soldier Support) of the seven branch clusters. Evidence of predictor differences across branch clusters and functional categories supports the need for further research on a branching algorithm. Table C.16 provides additional BMA results for branch satisfaction by branch cluster.

Table 32. Bayesian Model Averaging Results for Predicting Weighted 8-Factor Performance for Maneuver, Fires and Effects (MF&E) Branch Clusters

	Branch Cluster					
	Maneuver *n* = 412		Maneuver Support *n* = 295		Fires *n* = 226	
Predictor	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept	-.050		-.165		-.127	
Outcome Metric Score						
Academic Component Score	.000	27%	.047	**68%**	.005	28%
Leadership Component Score	.071	**90%**	.082	**84%**	.009	31%
Physical Component Score	.003	28%	.042	**61%**	.010	34%
Cadet Background & Experience Form						
Achievement	-.003	29%	.023	41%	.015	34%
Fit/Commitment	.006	31%	.010	32%	.197	**93%**
Response Distortion	-.035	**62%**	.010	34%	.029	47%
Peer Leadership	.001	27%	.017	42%	.014	35%
Fitness	-.020	40%	.019	38%	-.009	30%
Tolerance	-.013	35%	-.011	31%	-.200	**93%**
Work Values Inventory						
Profile Similarity Index	.005	29%	-.004	28%	.012	31%
Leader Knowledge Test						
Characteristics	-.010	29%	-.015	31%	-.033	34%
Skills	.008	29%	-.046	43%	.327	**84%**
Other						
Predicted Interest-Branch Fit	.007	28%	-.004	26%	-.006	26%
College Quality Index	-.020	**53%**	.015	39%	.002	26%

Note. *b* = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table 33. Bayesian Model Averaging Results for Predicting Weighted 8-Factor Performance for Operations Support (OS) Branch Clusters

	Branch Cluster			
	Intelligence, Surveillance, and Reconnaissance *n* = 249		Network Space Operations *n* = 158	
Predictor	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept	-.149		-.161	
Outcome Metric Score				
Academic Component Score	.009	31%	.010	30%
Leadership Component Score	.220	**100%**	.094	**87%**
Physical Component Score	.002	26%	-.013	34%
Cadet Background & Experience Form				
Achievement	.027	40%	.071	55%
Fit/Commitment	.120	71%	.070	54%
Response Distortion	.017	38%	-.002	31%
Peer Leadership	.020	41%	.057	61%
Fitness	.035	45%	.017	33%
Tolerance	-.233	**99%**	-.064	52%
Work Values Inventory				
Profile Similarity Index	.018	32%	.000	26%
Leader Knowledge Test				
Characteristics	.329	87%	.332	**67%**
Skills	.060	42%	-.360	**85%**
Other				
Predicted Interest-Branch Fit	-.012	27%	.003	25%
College Quality Index	-.128	**100%**	-.027	48%

Note.b = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table 34. Bayesian Model Averaging Results for Predicting Overall Weighted 8-Factor Performance for Force Sustainment (FS) Branch Clusters

Predictor	Branch Cluster			
	Health Services n = 127		ILC/SS n = 473	
	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept	.192		-.179	
Outcome Metric Score				
Academic Component Score	.045	46%	.031	65%
Leadership Component Score	.163	**95%**	.093	**98%**
Physical Component Score	.007	26%	.051	85%
Cadet Background & Experience Form				
Achievement	.022	33%	.077	73%
Fit/Commitment	-.010	27%	.066	60%
Response Distortion	-.009	29%	.037	55%
Peer Leadership	.026	40%	.007	40%
Fitness	.001	25%	.001	29%
Tolerance	-.010	28%	-.157	87%
Work Values Inventory				
Profile Similarity Index	-.011	27%	.002	28%
Leader Knowledge Test				
Characteristics	-.052	33%	.722	**100%**
Skills	.442	**78%**	-.450	**87%**
Other				
Predicted Interest-Branch Fit	-.336	77%	.083	81%
College Quality Index	-.139	**94%**	-.021	55%

Note. ILC/SS = Integrated Logistics Corp / Soldier Support. *b* = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table 35 presents validity evidence for the regression analyses that include all available predictors for the Validation Sample and by branch cluster. Overall, BMA *R* values were similar in magnitude to their single regression counterparts; this result indicates that the more stable BMA regression coefficients predict at a similar level of strength as the optimally weighted single regression models. For the three performance composites (Weighted 8-Factor, Can-do, Will-do) in the overall sample, BMA *R*’s were .299, .363, and .270, respectively.

In Table 36, BMA *R*’s for the Weighted 8-Factor Composite ranged widely across branch clusters (*R* = .180 – .528). Validity evidence by rank is presented in Appendix C, Table C.17.

Table 35. Validity of Optimized Predictor Composites for Validation Sample

Validation Sample	BMA *R*	Full Regression *R*	Full Regression Adj. *R*
	Criteria: Weighted 8-Factor, Can-do, and Will-do Performance		
Weighted 8-Factor (*n* = 1,940)	.299	.300	.278
Can-do (*n* = 1,940)	.363	.364	.347
Will-do (*n* = 1,940)	.270	.272	.247

Note. Criteria used linear regression models and the Validation Sample. Full Regression *R* is the multiple correlation of the OLS regression model including all predictors for continuous criteria and McFadden's Pseudo-*R*. Adj. *R* represents the estimated population cross-validity for the regression models including all predictors.

Table 36. Validity of Optimized Predictor Composites by Branch Cluster

Functional Category and Branch Cluster	BMA *R*	Full Regression *R*	Full Regression Adj. *R*
	Criterion: Weighted 8-Factor Performance		
Maneuver, Fires, & Effects			
Maneuver (n =412)	.180	.198	.027
Maneuver Support (n = 295)	.295	.304	.155
Fires (n =226)	.302	.319	.133
Operations Support			
Intelligence, Surveillance, and Reconnaissance (ISR) (n = 249)	.528	.534	.455
Network & Space Operations (n =158)	.440	.455	.285
Force Sustainment			
Health Services (n = 127)	.521	.529	.361
Integrated Logistics Corp / Soldier Support (ILC/SS) (n =473)	.370	.375	.305

Note. Criteria used linear regression models and the Validation Sample. Full Regression *R* is the multiple correlation of the OLS regression model including all predictors for continuous criteria and McFadden's Pseudo-*R*. Adj. *R* represents the estimated population cross-validity for the regression models including all predictors.

In general, predictor battery validities for branch clusters resembled those for the overall Validation Sample. However, validities tended to be higher for more homogenous branch clusters (Health Services and Intelligence, Surveillance, and Reconnaissance [ISR]), each of which contain one branch.

Summary

Overall, the validation results show that performance composites were well predicted by the predictors. Hierarchical regression analyses showed that CBEF components predicted performance above and beyond Cadet OMS components, indicative of their additional utility for predicting important in-unit outcomes. Based on bivariate validities and BMA analyses, the Leadership OMS was the most consistent predictor of performance across dimensions and samples alike. Additionally, CBEF Tolerance, CBEF Fitness, and the College Quality Index also predicted multiple performance criteria well, although College Quality Index was a negative predictor of performance. Finally, Physical OMS, LKT Skills, and CBEF Peer Leadership each predicted at least one criterion well.

From a personnel classification perspective, the key result from these analyses is that the predictors showed different patterns and magnitudes of prediction across branch clusters. In line with expectations, these predictive differences suggest that attributes relate to job performance differently based on branch cluster.

From a joint predictor-criterion space equivalence, we found that predicted performance scores were similar across the three focal performance criteria (Weighted 8-Factor, Can-do, and Will-do). However, a substantial degree of differentiation was demonstrated by comparing the performance criteria with the non-performance criteria. Therefore, these models were highly similar across performance criteria, although the models differed across branch clusters.

These results support our use of the Weighted 8-Factor performance criterion to conduct the officer classification simulation. However, the pattern of results indicate that similar results would be obtained if by-branch had been conducted using one of the alternate key performance criteria. In summary, the results of the validation analyses show distinction among the branch clusters and provide inputs and a foundation for classification simulations described in Chapter 4.

CHAPTER 4: OFFICER CLASSIFICATION SIMULATION

Paul J. Sticha and Ted E. Diaz

Personnel selection algorithms generally use a single set of predictor scores to identify job applicants who are most likely to perform well in a specific occupation. Frequently, these predictor scores reflect composites that are highly loaded on *Psychometric g* because this construct is an excellent predictor of performance for nearly all occupations (Schmidt &, Hunter 1998). However, the use of a single composite to allocate talented individuals across multiple occupations has limited capacity to improve personnel performance across multiple occupations in a classification context (Johnson, Zeidner & Scholarios, 1990). This limitation occurs because personnel allocation based on a single composite results in applicants being layered over those occupations. That is, the most "talented" applicants will be allocated to the most critical occupations, while the least "talented" applicants will be assigned to the least critical occupations. While this approach may provide benefits to highly critical occupations, it will also reduce the proportion of highly talented individuals who are assigned to less critical occupations. This approach may also impact other explicit organizational goals (e.g., equitable distributions of demographics over occupations.)

Personnel classification algorithms fundamentally differ from selection procedures because multiple predictor composites are simultaneously used to assign individuals across occupations with the explicit goal of better matching the characteristics (e.g., talents) of individuals with the requirements of various occupations (Johnson et al., 1990). By better matching personnel characteristics and job requirement demands, personnel classification algorithms have potential to improve the performance of individuals assigned to most occupations by capitalizing on differences among the predictor composites. Therefore, we used classification procedures to focus analyses on improving the overall level of predicted performance of the U.S. Army Officer Corps, although we also monitored officer levels of predicted performance within branches. While gains in officer performance across all branches would represent a desirable solution from a classification perspective, we focus on maximizing the total or average predicted performance and view demonstrating gains across most branches as acceptable.

We used a simulation method to model potential gains in officer performance because of the complexity of the current officer branching process. The current system involves a multistep procedure that considers individual factors (e.g., cadet branch preferences and cadet willingness to extend their ADSO for a preferred branch) as well as explicit U.S. Army policy goals (e.g., the distribution of high-quality officers across branches and ethnic-gender balance within each branch). The simulation procedure also allowed us to represent explicit policy goals as exogenous constraints that limit the potential utility of classification methods. Therefore, the simulation method provides a more accurate estimate of the performance gains that could be realized in consideration of explicit policy constraints.

The remainder of this chapter describes the process used to model the officer branch assignment process. The first section outlines the formulaic basis and key results regarding personnel classification theory. The second section describes the methods that were used to model gains in key outcome variables that could be realized through improved personnel classification based on the validity information from the previous chapters as well as important exogenous policy constraints (e.g., U.S. Army policy regarding race/ethnicity/gender requirements and cadet branch preference). The third section describes the simulation approach used to estimate the effects of alternative branching policies on predicted officer performance and other outcomes. The fourth section details the results for improving the overall performance of the U.S. Army Officer Corps within and across officer branches. The final section summarizes the potential utility and limitations of these findings.

Personnel Classification Theory

Early research to estimate the gains in performance that were possible from effective classification procedures made simplifying assumptions about the validity and correlations among classification composites (Brogden, 1954; Brogden, 1959). Brogden developed a general method to estimate the mean predicted performance (MPP) of individuals assigned to military occupations in accordance with a classification procedure (1954, 1959). The MPP is simply the average of predicted standardized performance scores. MPP quantifies performance gains associated with improved personnel assignment algorithms, and its computation uses a random assignment approach as the baseline. Accordingly, random assignment corresponds to an MPP = 0, and classification gains are indicated by positive MPP estimates. Brogden's estimates were based on the number of jobs, the correlation among the predictor composites, and the validity of the predictor composites. Brogden's approach assumed:

1. A constant correlation (r) between each pair of predictor composites;
2. Predictor equations with equal validity (v) across occupations; and
3. The population being assigned is infinite, so that there are no job quotas.

From these assumptions, Brogden (1959) deduced that potential MPP gains from optimal classification algorithms as:

$$MPP = v\sqrt{1-r}\,f(m).$$

Where *f(m)* is a function that gives the mean performance standard score as a function of the number of jobs (m) and the overall selection ratio.

Subsequent analyses demonstrated that the Brogden MPP equation provides a useful tool for understanding factors that affect classification utility even when these assumptions are violated (cf. Zeidner et al., 1997). Johnson and Zeidner (1990) identified and evaluated analytical estimates of MPP when the Brogden assumptions do not hold. Specifically, they relaxed assumptions regarding the constant correlation between pairs of predictor composites (Assumption 1 above) and equal validity (Assumption 2). Their analyses showed that MPP is closely approximated by:

$$MPP' = \bar{v}\sqrt{1-\bar{r}}\,f(m).$$

These results indicate that the validity of the predictor composites is essential for classification utility. In addition, Johnson and Zeidner (1990) demonstrated that substantial classification utility can be obtained when predictors are positively correlated because MPP depends on $\sqrt{1-\bar{r}}$.

Cascio (1982) illustrated that using two predictors to assign individuals to one of two jobs can increase MPP substantially over the use of a single predictor, even when the correlation between the predictor composites is .80 (cf. Brogden, 1951). Finally, Johnson and Zeidner (1990) showed that the Horst (1954) differential validity index (H_d) was closely related to MPP when the Brogden assumptions were made. We mention this result because analyses described in the previous chapter demonstrated that several of the pre-commissioning and non-cognitive predictors provided differential validity over officer branches and branch clusters. More recent work by DeCorte (2000) and Diaz (2012) further relaxed some of the assumptions of the Brogden formulation and generalized the procedures to incorporate classification policy constraints, applicant preferences, and the impact of classification tools, such as incentives. This work is relevant because officer branching currently takes place through a complex, multistep process that considers cadet branch preferences and U.S. Army requirements to balance high-quality cadets across branches and ensure gender and ethnic distributions within each branch.

More recent research has used a simulation approach to predict performance because many of these assumptions are not tenable (Johnson & Zeidner, 1990). Our simulation extends the simulation approach by incorporating important elements of the existing branch assignment process (e.g., cadet branch preferences and cadet willingness to extend their ADSO for a preferred branch assignment).

Use of a simulation approach also allowed us to optimize other specific outcome variables in addition to officer MPP. Therefore, the approach could be used to compare the predicted career continuance, branch satisfaction, or cadet preferences using a variety of branching procedures, in addition to officer performance, which was the primary criterion.

Simulation Architecture Method

This section describes the design requirements of the simulation, provides an overview of the process, and defines the conditions under which the simulation was run. The simulation was intended to provide a general method to evaluate the performance of officer branching procedures against various outcome measures. More specifically, the officer branching simulation was designed to meet the following requirements:

1. The simulation could be configured to represent a wide range of officer branching policies ranging from simple optimizations to multistage processes. This requirement was intended to allow modelling of current, historical, hypothetical, and proposed policies. In particular, we intended the simulation to represent (a) policies that assign cadets to branches to maximize the mean predicted officer performance of a cadet cohort, and (b)

the current policy, which allows highly rated cadets to choose their branch and assigns other cadets to optimize overall branch preferences.

2. The simulation could be optimized against and provide distributions of cadet predicted performance as officers, retention (i.e., career continuance), cadet preferences for assigned branches, and officer branch satisfaction.

3. The simulation could be applied to simulate actual and forecasted cadet populations and branch requirements. This requirement implies that the simulation has the capability to estimate a cadet's position on the OML, as well as his or her branch preferences and willingness to trade an extension to the ADSO for their branch of choice.

Simulation Organization

Figure 4 summarizes the simulation development process. We describe the layers of this figure starting at the top. The first layer represents actual data that were collected from samples of cadets and analyzed in previous chapters. These data were used to build the analytical components of the simulation. Included are the academic, leadership, and physical scores that are components of the OML, as well as other predictor variables, such as the RIASEC scores, CBEF composites, and the cadet college quality indicator. In addition, the data included variables that were used to develop three prediction models: (a) OMS, (b) an indicator variable representing whether a cadet was willing to trade a longer ADSO for his or her branch of choice, and (c) a rank order of branches for each cadet by preference.

The second layer represents four models that were developed to support the simulation: (a) a model describing the joint distribution of cadet characteristics, (b) a model estimating Cadet OMS based on its three components, (c) a model predicting whether a cadet would be willing to extend their ADSO for assignment to the branch of choice based on cadet characteristics, and (d) a model predicting cadet branch preferences based on cadet characteristics.

The third layer simulates the characteristics, ADSO extension, OML rank, and preferences of a cohort of cadets that will be subjected to a branching process. First, a simulated cohort is defined by a set of characteristics with marginal distributions and correlations that match those in the corresponding variables in the actual data. The simulated cadet characteristics are then used as input to the three models to predict the OML components, ADSO extension, and branch preferences. The predicted officer performance, career continuance, and branch satisfaction are also calculated for each branch at this time, based on the regression coefficients described in the previous chapter that predict the Weighted 8-Factor performance composite, and the regression coefficients described in Appendices B and C that predict continuance and branch satisfaction, respectively.

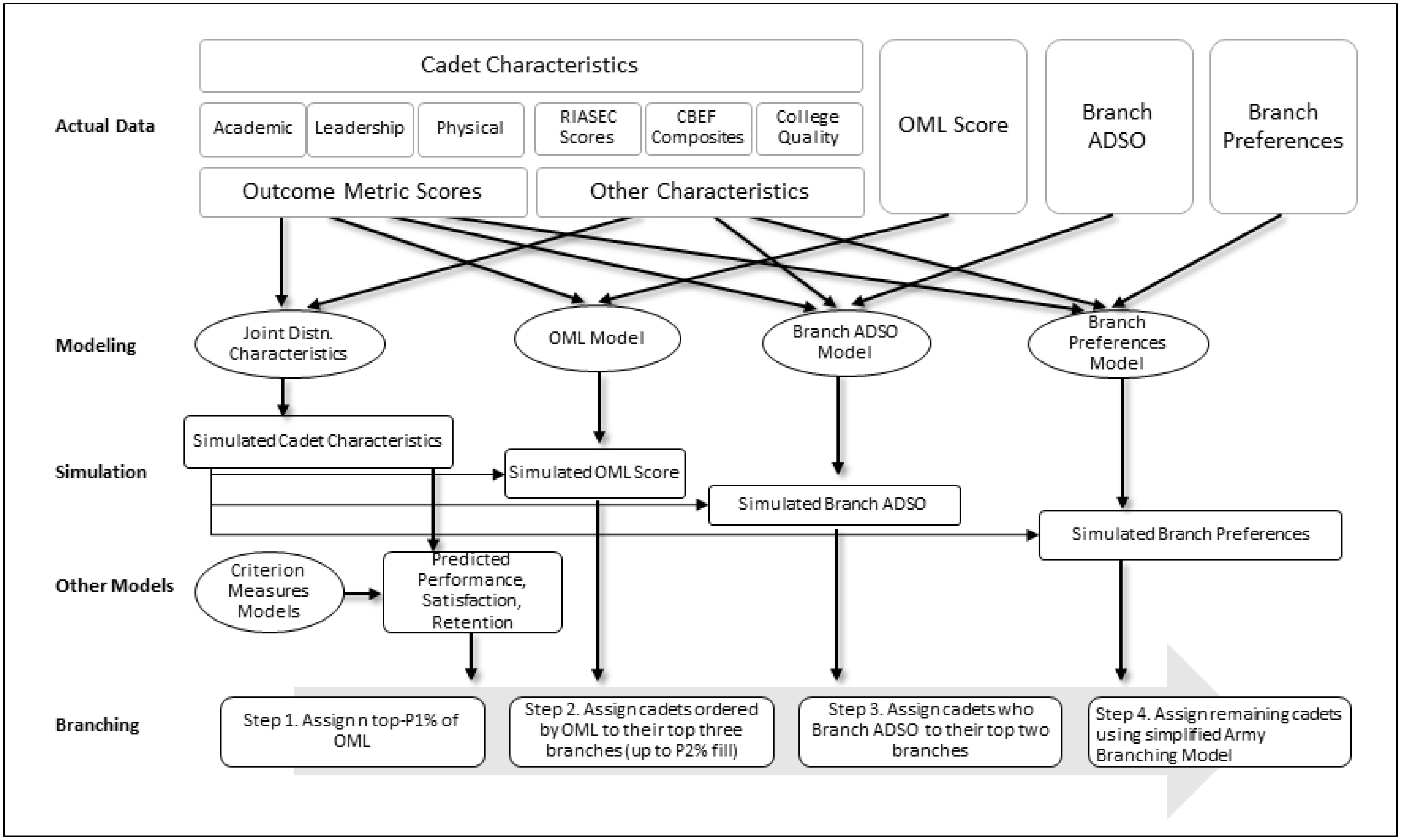


Figure 4. Organization of the simulation development process.

The fourth and final level simulates the branching process (i.e., assigning simulated cadets to branches according to the branching policy). The branching process consists of four steps that correspond to current branching procedures. However, these steps are implemented in a flexible way that allows the simulation to represent a wide range of branching policies, as shown in the following description.

1. In the first step, cadets at the top of the OML (currently top 10%) receive their first choice of branch. The percentage of cadets who are eligible for this step can be varied, and if the percentage is set to zero, then this step would be skipped.

2. In the second step, cadets who were not assigned a branch in the first step are processed in order of their OML rank. The cadets are placed in one of their top three branches if the current fill for the branch is less than a specified amount (currently 40%).

3. In the third step, unassigned cadets who have agreed to an extended ADSO are assigned by OML rank to one of their top two branches of choice if the current fill for the branch is less than a specified amount (currently 55%).

4. The fourth step assigns cadets to branches according to an optimization, based on a simplified version of the Army Branching Model, allowing the objective function to change.

    a. The current procedure maximizes cadet preference, multiplied by position in the OML.

    b. An alternative procedure maximizes predicted officer performance, with ties (due to branch clustering) broken by cadet preference. In addition, the optimization can be based on predicted branch satisfaction or career continuance.

    c. Finally, optimization can be based on a combination of multiple objectives, such as a combination of predicted officer performance and career continuance. A quality constraint was imposed in this step so that the percentage of quality cadets (top 50% of OMS distribution) is at least 40% and at most 65% of the total for each branch.

Simulation Conditions

The number of branching policies that can be represented within this simulation framework is unbounded. However, we focused on the eight conditions shown in Table 37 to assess the capabilities of a range of classification goals. The first of these conditions (Condition 1) represents a simplified version of the current process that does not address gender and racial/ethnic balance. Conditions 2 through 4 represent optimizations that maximize the total level of predicted officer performance, branch satisfaction, or career continuance, respectively, within the cohort. Conditions 5 through 7 add some of the steps from the current system to the optimization conducted in Condition 2. Condition 8 conducts an optimization of a combination of predicted officer performance and predicted career continuance. Finally, the predicted criterion values (e.g., predicted officer performance) were calculated for actual branch assignments for comparison purposes (Condition 0).

Table 37. Conditions Represented in the Simulation

Simulation Condition	First Choice for top 10% of OML	First 3 choices until 40% fill	Trade ADSO for first 2 choices until 55% fill	Objective of optimization for remaining Cadets	Consideration of gender and race balance	Review of Proposed Solution
0 – Actual Assignments	✓	✓	✓	Preference	✓	✓
1 – Simulation of Current Method	✓	✓	✓	Preference		
2 – Optimize Predicted Performance				Performance		
3 – Optimize Predicted Satisfaction				Satisfaction		
4 – Optimize Predicted Continuance				Continuance		
5 – Performance + 10% choice	✓			Performance		
6 – Performance + 10% and 40% choices	✓	✓		Performance		
7 – Performance + 10%, 40%, and 55% choices	✓	✓	✓	Performance		
8 – Optimize Predicted Performance and Continuance				Performance & Continuance		

Simulated Data Generation

We employed a simulation approach to estimate effects of alternative branching policies on preferences, predicted officer performance, branch satisfaction and career continuance likelihood. This approach is graphically summarized in Figure 4. The starting point for conducting the simulation is the population generation model to create OMS component scores and other cadet characteristics which, in turn, are input to prediction models to predict primary inputs to the branching algorithm, namely, OMS, branch ADSO and branch preferences. The population generation model, OMS, branch ADSO, and branch preference prediction models are described below. The simulation approach also computes outcome variables (officer performance, branch satisfaction and career continuance) from cadet scores and characteristics, with associated prediction models that were developed in earlier chapters.

Population Generation Model

The purpose of the population generation model is to produce a simulated cadet population with characteristics that match the actual cadet distribution of variables corresponding to OMS component scores and other cadet characteristics. Altogether we included 20 input variables encompassing the 14 predictor composites enumerated in Table 9 as well as the scores for the 6 RIASEC vocational interest dimensions defined in Appendix A (Refer to Table A.1).

We used an approach based on copulas to specify a multivariate distribution that jointly characterizes the 20 input variables (Nelsen, 2006). The copula approach is a flexible method for constructing a joint distribution, allowing modeling of marginal distributions of random variables and their dependencies separately. The approach can be viewed as a generalization of the inverse cumulative distribution function (CDF) method, in which the inverse CDF is applied to a uniform distribution (i.e., a random number between 0 and 1) to sample from a target distribution. In the copula approach, a d-dimensional pseudo random vector is sampled from a copula, a multivariate distribution with uniform (0,1) marginal components, then component-wise inverse CDF transformations are applied using the marginal CDFs of the target d-dimensional joint distribution. In this generalization, marginal CDF's are modeled separately and the dependency of the components of the copula distribution are specified such that the component-wise inverse CDF produces the dependency in the target joint distribution.

We constructed the joint distribution of Cadet OMS and other characteristics in the simulation using the empirical cumulative distribution function to estimate marginal distributions and a Gaussian copula to model dependencies across variables. We used available cadet data from 2010 to 2016 to estimate joint distribution of cadet variables separately by year and gender, which provides the flexibility to choose a specific cohort by year or mixture of years to match future cadet distribution. In total, we estimated two overall joint distributions by gender combining all available years and eight joint distributions by gender for the 2013 to 2016 cohorts.

Both the marginal distributions of the simulated variables and their intercorrelations closely matched the corresponding characteristics in the cadet population. Results of this comparison are presented in Appendix D.

Predicting OMS. Cadet OMS is computed as a function of OMS composites based on policy that can change from one year to another. We estimated a model to predict OMS using linear regression with Academic, Leadership and Physical OMS components as predictors. Prediction models were estimated separately for 2013 to 2016 cohorts. Table 38 shows cross-validated correlations between predicted and actual OMS for each year. For 2015 and 2016 outcome metric scores are almost deterministically related to OMS component scores, as expected given that OMS is a weighted function of OMS component scores. Quality of prediction for 2013 and 2014 is not as high as in 2015 and 2016 but are still excellent.

Table 38. Cross-Validated Correlation Between Predicted and Actual Outcome Metrics Score (OMS)

	Year			
	2013	2014	2015	2016
Cross-Validate R	.954	.958	.996	.999

Predicting ADSO Extension for Branch Choice. We modeled cadets' willingness to trade an extended ADSO for branch of choice using a logistic model with 20 predictors. Estimated coefficients for the logistic model are reported in Table 39, which shows academic and leadership composites are most highly statistically significant predictors with negative coefficients. This implies that cadets who score lower on Academic and Leadership components have higher probability of extending their ADSO for branch choice, as one might expect.

Table 39. Estimated Coefficients of Logistic Model of Probability of Willingness to Extend Active Duty Service Obligation (ADSO)

Predictor	Estimate	*SE*	*t*	*p*
Intercept	0.634	.176	3.606	.001
Outcome Metric Score				
Academic Component Score	**-.084**	**.006**	**-13.518**	**.001**
Leadership Component Score	**-.043**	**.007**	**-6.411**	**.001**
Physical Component Score	-.014	.007	-2.016	.044
Cadet Background & Experience Form				
Achievement Composite	-.057	.020	-2.844	.004
Fit/Commitment Composite	.046	.017	2.713	.007
Response Distortion Scale	-.006	.009	-.697	.486
Peer Leadership Scale	.005	.012	.420	.675
Fitness Motivation Composite	.030	.011	2.666	.008
Stress Tolerance Composite	.014	.019	.730	.465
Work Values Inventory				
Profile Similarity Index	.017	.014	1.159	.246
Leader Knowledge Test				
Characteristics Score	.013	.043	.292	.771
Skills Score	-.067	.041	-1.613	.107
Major RIASEC Score				
Realistic	-.017	.007	-2.502	.012
Investigative	-.015	.009	-1.580	.114
Artistic	-.025	.011	-2.385	.017
Social	.004	.007	.531	.595
Enterprising	-.019	.011	-1.719	.086
Conventional	-.019	.014	-1.395	.163
Other				
Predicted Interest-Branch Fit	.024	.015	1.585	.113
College Quality Index	-.010	.006	-1.625	.104

Note. Values of highly statistically significant predictors with negative coefficients are bolded.

We converted cadets' probability of extending ADSO estimated from the model into predicted ADSO behavior (i.e., 0/1 predicted behavior) using a threshold probability above which a cadet is predicted to extend ADSO. Using a hold-out sample we identified a threshold value of 0.34, which closely reproduced the percentage of cadets who extended ADSO. The confusion matrix in Table 40 shows cross-tabulation of actual versus predicted ADSO extension behavior with an overall classification accuracy of 67.2%, which is reasonably good.

Table 40. Confusion Matrix of Actual vs. Predicted ADSO Behavior

		Actual Branch ADSO		
		No	Yes	Total
Predicted Branch ADSO	No	4,364	1,261	5,625
	Yes	1,294	876	2,170
	Total	5,658	2,137	7,795

Note. ADSO = active duty service obligation.

Predicting Branch Preference Rankings. Cadet branch preference is a key input to the branching process. Each cadet is typically assigned to his/her most preferred branch available during his/her turn in the branching process as determined by his/her Cadet OMS score. Generating branch preferences to associate with simulated cadets was therefore needed in the branching policy simulations. In the following description we provide an overview of our approach to model cadet preference ranking. A more detailed description is given in Appendix D.

All 17 branches (see Figure 1) were considered in the branching policy simulation analysis. Because some of the data were collected at a time when females were not allowed in combat branches, we estimated a branch preference model separately for males and females. The model used cadet preference information that was provided in the form of a list of branches rank ordered by preference for each cadet. Almost all cadets rank-ordered their branch preferences from 10 to a maximum of 15 of the branches; only these cadets were considered in the modeling. Branches not included in cadets' preference list were randomly ordered and appended to the bottom of the list. This randomization did not have any substantive effect on the results because very few cadets are assigned a branch outside of their top ten preferences. We used the full set of 20 variables consisting of OMS composite scores and other cadet characteristics as predictors of branch preference. Altogether we had a sample size of 7,249 cadets with 6,136 males and 1,113 females.

After considering several options, we employed neural network multivariate regression to model cadet branch preference. This method treats rankings of 17 branches as a multidimensional or vector valued response variable. We employed rectified linear unit (ReLU) activation functions and included an error or stochastic component with variance that depends on predictors (i.e., heteroscedastic error). With the addition of the error component, the model can vary the predicted rank ordering of branches for the same or fixed values of the predictor variables to account for model uncertainty. We used standard multivariate linear regression as a preliminary step to identify a subset set of variables to include in the model to control the number of parameters in the neural network and help control overfitting. A separate hold-out sample was also used to monitor overfitting while parameter estimation was carried out on a separate sample.

The overall fit of the estimated model was reasonable for both male and female cadets. The detailed results are presented in Appendix D. Overall, the model was able to track actual preference distributions for all branches, including branches with unusual patterns at or near the top rank, such as Armor, Aviation, and Field Artillery.

Simulation Results for Branch Classification

We generated 30 cadet populations each with 2,870 total cadets of which 75% were males and 25% are females. Generated data included all input required at each step in the branching algorithm (i.e., branch preferences, OMS, and decision to trade longer ADSO for branch of choice) and officer performance, branch satisfaction, and career continuance criterion scores. The total number of cadets was based on FY 2016 branch requirements, while gender allocation was based on the gender distribution in the Validation Sample. We processed all eight policy conditions listed in Table 37 for each of the 30 replications, for a total of 240 simulation runs. At the end of each simulation run we computed predicted officer performance, branch satisfaction, and career continuance scores for each cadet in their assigned branch. We compared the distribution of predicted scores for the overall population and by branch across policy conditions. This section presents general results, focusing primarily on performance. Supplemental information is presented in Appendix D.

Prediction Correlations

Although classification utility is limited when the predicted officer performance for different branches is highly correlated, optimal classification can improve performance even when the correlations among the predictor branch composites are moderately high (Cascio, 1982). Table 41 presents the correlation between the predictor branch composites for the simulated populations. The mean correlation between clusters is .55. Incorporating this correlation into the Brogden formula indicates that the level of classification utility is 67% of what it would be if the correlations were zero. Thus, the correlations of predicted officer performance by branch cluster enable meaningful levels of classification utility.

Table 41. Correlation of Predicted Officer Performance in Simulated Sample by Branch Cluster

Branch Cluster	Maneuver	Maneuver Support	Fires	ISR	Network and Space	Health Services	ILC/SS
Maneuver[a]	—						
Maneuver Support[a]	.428	—					
Fires[a]	.148	.428	—				
ISR[b]	.756	.654	.534	—			
Network and Space[b]	.247	.741	.683	.704	—		
Health Services[c]	.526	.484	.233	.696	.481	—	
ILC/SS[c]	.456	.887	.554	.774	.793	.378	—

Note. ISR = Intelligence, Surveillance, and Reconnaissance, ILC/SS = Integrated Logistics Corps/Soldier Support
[a] Maneuver, Fires, & Effects, [b] Operations Support, [c] Force Sustainment.

Simulation Quality

We used the full correlation matrix to generate the simulated population data so that the fit/quality of the simulated data would likely be very high. As a check on this expectation, we directly compared the entire distributions of the actual and simulated data from the generation model and preference model. Those comparisons indicated a high degree of consistency between the actual and simulated data and are described in Appendix D.

To ensure that the simulation was performing according to the design requirements, we reviewed the values of all criterion variables at each step in the simulation process for Condition 1 (preference), which simulates the current branching process. If the simulation is working as designed, we would expect that the predicted officer performance would be greatest for the cadets assigned in the first step in the process and would decrease in the later steps, since each step uses a less selective segment of the population than the previous step. In addition, we would expect branch assignments in the first step to be the most preferred choice, while assignments in the second step would be to one of the first three most preferred branches, and choices in the third step would be to one of the first two most preferred branches. Finally, we would expect those who agree to extend their ADSO in exchange for their branch of choice to show greater predicted continuance than other steps.

Figure 5 is a box plot that shows the distribution of each criterion variable by the step in the process. The box represents the middle 50% of the population over multiple runs of the simulation, with the vertical line within the box representing the median score on the criterion variable for each Step. The gray vertical lines in the figure show the overall median criterion score for all steps in the simulation. As would be expected, the overall median officer performance score over multiple runs of the simulation (in z-score units) is close to zero for the simulation. Recall that Steps 1 and 2 in the current branching process branch cadets based on their OML ranking. The median predicted officer performance score at Steps 1 and 2 is higher than the median of zero. Steps 3 and 4 of the branching process account for (a) extending ADSO to obtain a desired branch and (b) other constraints such as quality. The median predicted performance scores at Steps 3 and 4 are lower than the overall median predicted performance of the simulation.

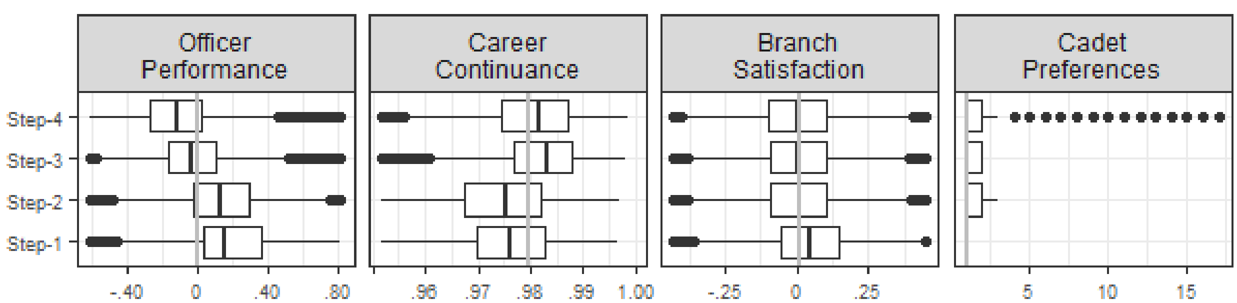


Figure 5. ***Distribution of cadet simulated scores for simulated current Condition 1 by branching step.***

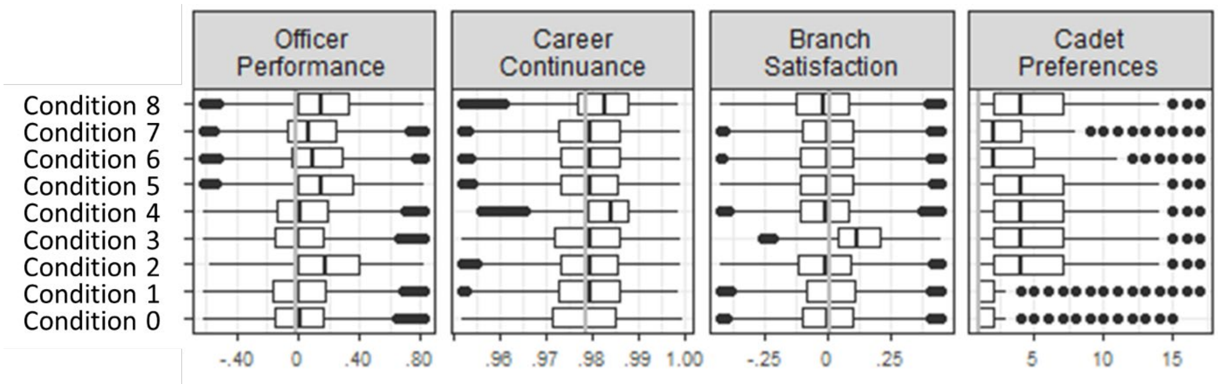
The results for both cadet preferences and officer performance variables are consistent with the descriptions and expectations for these steps. Cadets assigned in Step 1 receive their first choice; those assigned in Step 2 receive one of their first three choices; and those assigned in Step 3 receive one of their first two choices. Finally, in Step 4, most cadets receive their first choice, but overall assignments at this step cover the entire range of 1 through 17. Performance results also correspond to expectations with each step making assignments with somewhat lower predicted performance than the previous step. That is because the first step is very selective, drawing from the top 10% of the cadet population, while succeeding steps are increasingly less selective. There is little difference in predicted branch satisfaction among cadets assigned their branch at different steps. Predicted career continuance is higher for cadets receiving their assignments in the third and fourth steps than for those receiving assignments in the first or second steps – this is also consistent with our expectations

Overall Classification Gains

The remainder of the analysis compared the simulation results between conditions. We used paired *t*-tests to compare the mean predicted criterion value in a simulation condition that optimized a criterion (e.g., predicted officer performance was optimized in Condition 2) to the comparable mean in a condition that simulated the current branching process (i.e., Condition 1). The means were calculated over the 30 replications of the simulation for each condition. Because of the large number of simulated cadets (n = 86,100), very small differences between conditions can be statistically significant. Consequently, we supplemented our statistical analysis by reporting effect sizes as measured by Cohen's d. The values of d that we report have been adjusted to reflect the estimated population variance, rather than the reduced variance of the simulated data. This adjustment considers the validity of the prediction equations for the criterion variables, and the restriction of range that results from the assignment process. We applied the adjustment to estimates of officer performance and branch satisfaction. Because career continuance is estimated using a logistic model, rather than a linear model, we did not apply the adjustment to this variable. For a similar reason, we did not calculate effect sizes for cadet preference ranks.

Figure 6 shows a box plot of the distribution of predicted officer performance, career continuance, and branch satisfaction, as well as cadet preferences. The simulation had eight conditions that could be compared to each other, or to the actual branching process based on data from the Validation Sample (Condition 0):

- Condition 1 was a simulation of the current branching process that focuses on cadet preference,
- Condition 2 simulated optimization of officer performance,
- Condition 3 simulated optimization of branch satisfaction,
- Condition 4 simulated optimization of career continuance/retention,
- Conditions 5-7 simulated elements of the current branching system while optimizing officer performance, and
- Condition 8 simulated optimization of a combination of officer performance and career continuance.



Note. Condition 0 = data from Validation Sample. Simulation conditions are: 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Figure 6. Distribution of cadet simulated scores by condition.

Comparing Condition 0 and Condition 1 gives an indication of the accuracy of the simulation (See Appendix D, Table D.1). Comparing the distribution means indicated that simulated cadets were assigned branches that were slightly lower in their preference ranking than the actual cadets (mean rank difference = -0.26, d = -0.17). The differences between the actual and simulated cadets were also very small for officer performance (mean difference = 0.001, d = 0.01), branch satisfaction (mean difference = .006, d = .006), and career continuance (mean difference = .001, d = 0.06). These results indicate that the simulation does well in predicting the criterion outcomes for the existing branching process.

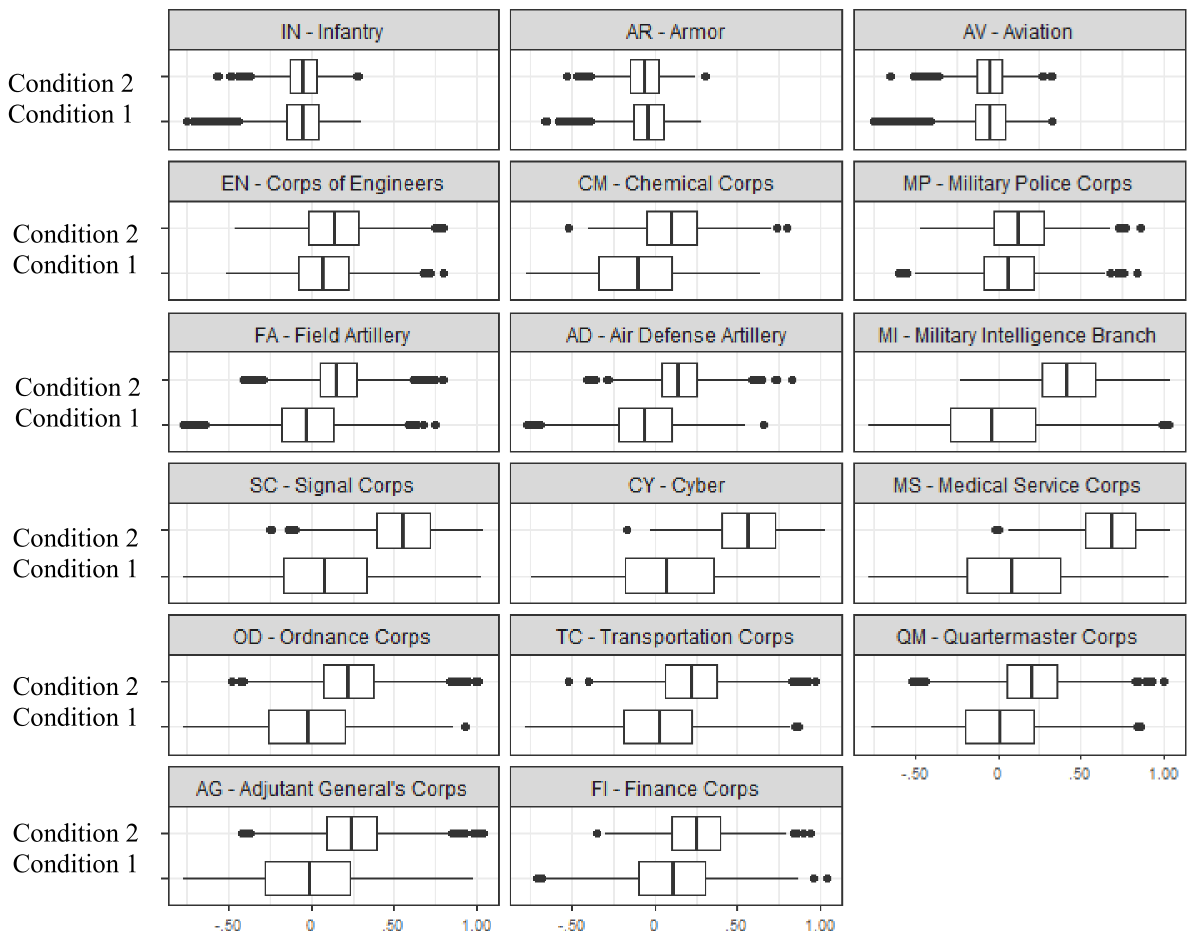
We compared the simulated scores for Conditions 2, 3, and 4 to the scores for Condition 1 to assess the magnitude of the effect of optimization for officer performance, branch satisfaction, and career continuance, respectively. Differences between conditions were significant for officer performance (mean difference = .248, $t(29) = 80.5$, $p < 0.001$, $d = 0.25$), branch satisfaction (mean difference = .191, $t(29) = 55.8$, $p < 0.001$, $d = .19$), and career continuance (mean difference = .008, $t(29) = 44.9$, $p < 0.001$), indicating that optimizing on a criterion variable can lead to a substantial gain in that variable.

We also compared the preference distribution between these conditions to determine whether optimization on one of the criteria had a detrimental effect on the preference for the assigned branch. The results indicated that it did. This difference is substantial, with the average difference in rank of more than 3.5. *T*-tests were significant with $p < 0.001$ for all conditions, compared to Condition 1 (preference). This difference in preference was reduced, while maintaining much of the improvement in officer performance, when the first two steps of the current procedure were incorporated (Condition 6).

Finally, maximizing a combination of officer performance and retention (Condition 8) was found to produce two-thirds the improvement in performance (mean difference = .16, $t(29) = 36.5$, $p < 0.001$, $d = 0.16$) and more than half of the improvement in career continuance (mean difference = .005, $t(29) = 22.9$, $p < 0.001$) as the corresponding conditions in which these variables were maximized individually (Conditions 2 and 4, respectively).

Branch Classification Gains

To examine the results by branch, we focused on the predicted officer performance. Boxplots of the distribution of predicted officer performance for Condition 1, which simulated the current branching process, and Condition 2, which maximized predicted performance, are presented by branch in Figure 7. This figure shows the contrast between the very small differences between the conditions for Infantry, Armor, and Aviation, and the much larger differences in other branches (i.e., Military Intelligence, Signal Corps, Cyber, and the Medical Service Corps). These differences correspond to the differences in the validity of the performance predictors, with the Maneuver cluster having a validity coefficient of .18, while the branches with high improvement have validity coefficients of at least .44. Appendix D provides additional results for career continuance/retention, branch satisfaction, and cadet preference.



Note. Simulation Condition 1 = current branching process that focuses on cadet preference, Condition 2 = optimization of officer performance.

Figure 7. Distribution of cadet simulated predicted officer performance scores by condition.

Table 42 shows the adjusted effect sizes corresponding to the improvement differences between Condition 2 (performance) and Condition 1 (cadet preference). For all branches except Armor, the difference was positive, indicating that optimizing predicted officer performance improves the predicted performance across branches. The adjusted effect sizes were greater than 0.5 *SDs* for the following four branches: Military Intelligence, Signal Corps, Cyber, and Medical Service Corps. In addition, the adjusted effect sizes were greater than 0.2 *SD* for the following six branches: Chemical Corps, Air Defense Artillery, Ordnance Corps, Transportation Corps, Quartermaster Corps, and Adjutant General Corps. The low validity of the performance predictors for the maneuver cluster worked in two ways to reduce the effect sizes for the branches within this cluster. First, the predicted performance scores for this cluster are all relatively close to the mean of the performance distribution, which limits the improvement in predicted performance that is possible. Second, because the variance of predicted performance is low in the simulation results, the adjustment to the population is relatively large, which further decreases the obtained effect size.

Table 42. Adjusted Effect Size of Optimizing on Officer Performance vs Cadet Preference

	Condition 1		Condition 2			
Branch	Mean	SD	Mean	SD	Validity	Adjusted Effect Size
IN - Infantry	-.059	.143	-.056	.120	.180	.003
AR - Armor	-.042	.135	-.064	.123	.180	-.023
AV - Aviation	-.055	.142	-.052	.119	.180	.003
EN - Corps of Engineers	.077	.208	.141	.206	.295	.065
CM - Chemical Corps	-.116	.279	.109	.202	.295	.228
MP - Military Police Corps	.065	.211	.128	.203	.295	.064
FA - Field Artillery	-.029	.229	.164	.166	.302	.198
AD - Air Defense Artillery	-.062	.226	.155	.164	.302	.222
MI - Military Intelligence Branch	-.067	.403	.435	.241	.528	.551
SC - Signal Corps	.075	.367	.554	.229	.440	.505
CY - Cyber	.076	.378	.564	.233	.440	.514
MS - Medical Service Corps	.097	.434	.754	.269	.521	.709
OD - Ordnance Corps	-.038	.318	.228	.217	.370	.275
TC - Transportation Corps	.014	.292	.227	.218	.370	.220
QM - Quartermaster Corps	.007	.290	.213	.220	.370	.214
AG - Adjutant General Corps	-.042	.359	.250	.223	.370	.300
FI - Finance Corps	.106	.288	.255	.215	.370	.155

Note. Simulation Condition 1 = current branching process that focuses on cadet preference, Condition 2 = optimization of officer performance.

We investigated the extent to which a large variation in predicted criterion values was related to high validity in the assessment of the criterion, in accordance with Brogden's formula. The results of the analysis for officer performance are shown in Figure 8, while results for the other criteria are provided in Appendix D. Figure 8 plots the standard deviation of the median predicted performance across simulation conditions on the y-axis, and the validity of that criterion assessed using Bayesian model averaging on the x-axis.

There was a substantial positive relationship between the standard deviation of the median performance across conditions and the validity of the regression equation predicting that criterion. That is, predicted officer performance was most affected by the simulation conditions for the branches in which performance could be predicted with high validity. This relationship was substantial, with the standard deviation exhibiting an order-of-magnitude increase over the range of validity. This result suggests that optimization is more effective for branches for which the performance can be predicted more accurately. This result is consistent with Brogden's (1959) formula.

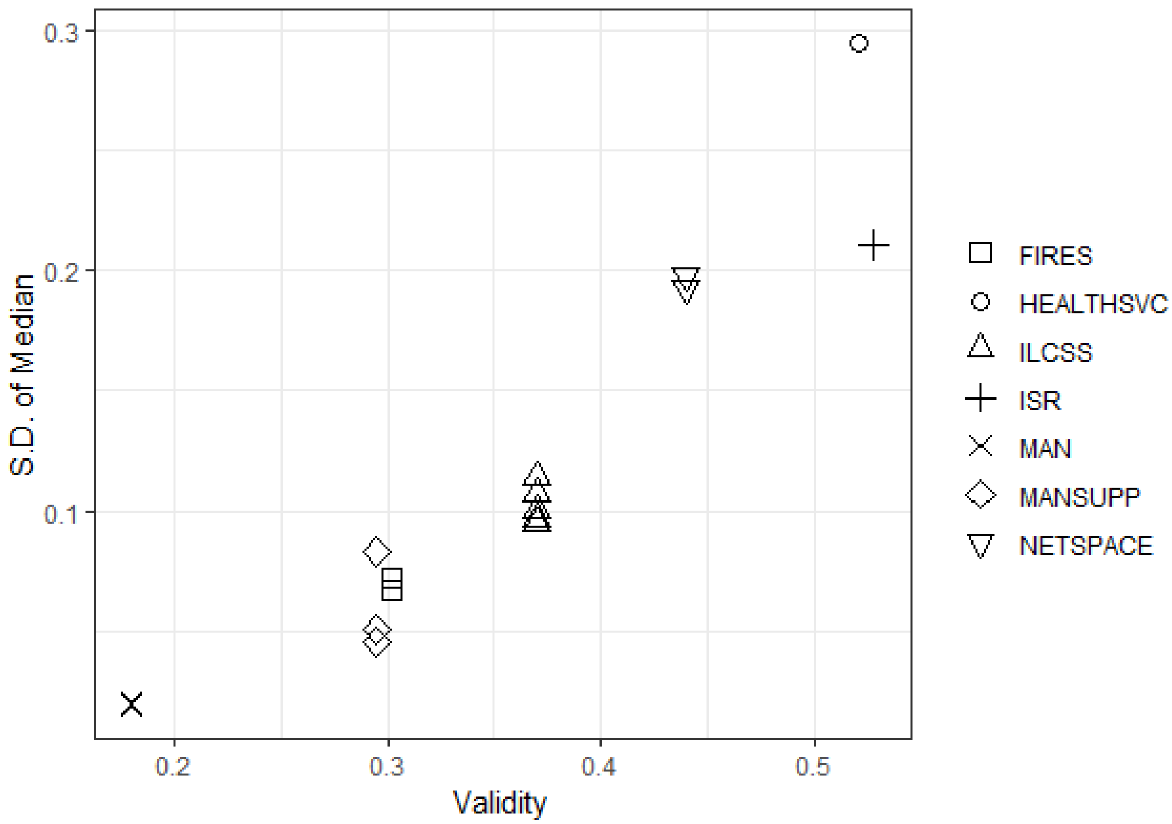


Figure 8. ***Cluster performance validity (BMA) and standard deviation of median across conditions.***

Summary

The simulation process was designed to provide a general capability to evaluate competing procedures to improve officer in-unit performance and continuance metrics by basing branch assignment decisions upon non-cognitive and cadet performance indices that had been collected during the USACC pre-commissioning program. Although the simulation simplified aspects of the current process, the baseline simulation produced solutions that closely matched actual allocations regarding the predicted levels of officer performance, branch satisfaction, career continuance, and cadet preference for branch assignment that were based on the empirical data and analyzed in Chapter 3. Importantly, the simulation enabled us to demonstrate that changes to the branch assignment procedures, coupled with the use of available predictor information, would likely result in improvements for important officer outcome variables such as officer performance and retention/continuance.

This approach allowed us to quantify the extent to which the validity of performance predictions affects the extent to which predicted criterion levels can be improved by optimizing the use of this information during the branch assignment process. Clearly, improving the validity with which we can predict officer performance, branch satisfaction, and career continuance will lead to improvements in the effectiveness of branch assignment methods. The results of the simulation indicated that substantial improvements in job performance over the current branch assignment method could be obtained for four branches (Military Intelligence, Signal Corps, Cyber, and Medical Service Corps), and modest improvement for branches (Chemical Corps, Air Defense Artillery, Ordnance Corps, Transportation Corps, Quartermaster Corps, and Adjutant General Corps).

However, the effects of limited predictive validity were particularly noticeable for the Maneuver branches (Infantry, Armor, and Aviation), for which almost no improvement in officer performance were predicted. This result suggests that future projects should emphasize the development and validation of scales that can be used to improve the validity of the predictor composites for these branches.

Finally, the simulation has been used to address a small number of potential assignment methods to illustrate its utility. We believe that application to a wider range of methods would establish its validity and lead to the development of new features to enhance its capability.

CHAPTER 5: CONCLUSIONS AND NEXT STEPS

Laura A. Ford, Teresa L. Russell, and Peter J. Legree

The goals of this project were to: (a) empirically evaluate the validity of a range of pre-commissioning and non-cognitive predictor measures against officer performance and career continuance metrics; and (b) evaluate the use of this information to modify the branch assignment process for newly commissioned officers so as to improve the aggregate performance and continuance of the U.S. Army officer corps. In addition, we structured our analyses to extend psychological theory with a focus on personnel selection and classification issues.

Although a concurrent validity design would have simplified construction of the predictor space and many of the validity analyses, we utilized a longitudinal design due to concerns that a concurrent design might inflate scale validity estimates and provide misleading results. Therefore, all empirical analyses were conducted using a longitudinal design so that all predictor data had been collected during pre-commissioning training, while all outcome criteria were collected after the cadets had become commissioned officers. Furthermore, we targeted officers who were currently serving in operational units and obtained performance ratings of these junior officers from their direct supervisors. Finally, we emphasize that this design provided a 2 to 8-year delay between collection of the non-cognitive and pre-commissioning metrics and the collection of the supervisor performance rating data.

To appreciate the importance of these results, it is necessary to recognize that conventional selection procedures cannot support personnel classification goals when multiple occupations compete for high-quality individuals identified using a single predictor composite. This limitation reflects the fact that numerous branches cannot be assigned disproportionately large numbers of high-quality cadets using a single predictor composite or highly redundant predictor composites (cf. Brogden, 1959; Jonson et al, 1990; Scholarios et al., 1994; Zeidner et al., 1997). Meeting classification goals requires (a) composites with differential validity to identify individuals who will perform very well in specific occupations, but only modestly or poorly in other occupations; and (b) simulation analyses to model the effects of the classification composites on the aggregate performance of the officer corps.

We believe that our results provide a strong basis to extend psychological theory and address personnel assignment goals for U.S. Army. At a very general level, our results confirmed earlier analyses showing metrics that have been traditionally collected by the USACC command and used to develop the Cadet OML scores provide a valid metric to identify cadets who are most likely to become proficient junior officers (Legree et al., 2019). However, our analyses also demonstrated that differentially weighting the USACC pre-commissioning metrics, as well as the non-cognitive predictors using data collected during pre-commissioning training, could improve the prediction of individual officer performance within specific officer branches. Our results also showed a high degree of equivalence among predictor composites developed against a host of alternate performance measures, as well as divergence with predictor composites computed against non-performance outcomes (e.g., officer branch satisfaction and officer career intent). From a practical perspective, the simulation demonstrated that officer performance within most branches could be improved by better aligning the talents of individual cadets with the branches to which these individuals are assigned. Each of these issues is addressed more thoroughly below.

Officer Selection

As described in Chapter 1, the ROTC branching process has been traditionally based on cadet ranking on the USACC Cadet Order of Merit List (OML), cadet branch preference, and U.S. Army officer branch requirements. Within this system, the Cadet OML score has functioned as a selection tool to ensure that cadets who are selected for the Active Duty component and critical branches are most likely to become highly productive officers.

Consistent with USACC procedures and expectations, the Cadet OMS component scores were the strongest predictors of each of the four key officer performance metrics (i.e., the Weighted 8-Factor Performance, the Can-do, the Will-do, and the Mean Supervisor Rating composites). In addition, the OMS Leadership component was the strongest predictor of performance for each of these key composites. This pattern of results indicates that the Cadet OML score has been and is likely to continue to be a key metric for identifying and awarding scholarships to individual cadets who are likely to become highly proficient officers (cf. Legree et al., 2019). It also suggests that USACC training and development procedures have functioned well to develop cadet capabilities and become proficient junior officers.

Differential Validity over Branch Cluster

To explore differential validity issues, we grouped officer branches into clusters to ensure sufficient sample sizes for the regression analyses. Validity results are detailed in Table 28, which presents the predictor by criterion correlation matrices across branch clusters using the Weighted 8-factor Performance composite. As expected, differential patterns of predictor by performance correlations were found across the various branch clusters. For example, although the Leadership OMS component was a significant positive predictor of performance across all branch clusters (except for the Fires cluster), the magnitude of its effects varied substantially by branch cluster from .37 in the Intelligence, Surveillance, & Reconnaissance (ISR) cluster to .14 in the Maneuver cluster. Likewise, the validity estimates for the CBEF Achievement predictor composite varied widely across the branch composites. Several other predictors also displayed differential patterns of validity depending on branch cluster.

We then conducted analyses using conventional regression and BMA procedures to improve the prediction of performance within the various branch clusters. The key result from these analyses is that the available predictors showed different patterns of prediction across the branch clusters. These predictive differences suggest that attributes relate to job performance differently based on branch cluster. This result is critical from the perspective of improving overall officer performance because it broadly supports the classification goal of better matching cadet characteristics to officer requirements that vary by branch.

In addition, the BMA results by branch cluster suggested that several predictor measures differentiated against the officer Weighted 8-Factor Composite among branch clusters:

- The Tolerance Composite (measured by CBEF scales) was a more critical predictor of performance for some branches than others.
- Knowledge of leadership requirements as measured by both LKT scores (Characteristics and Skills) were critical predictors for predicting branch performance in some clusters and not in others.
- The Predicted Interest-Branch Fit varied in its efficacy for predicting performance across branches.
- The College Quality Index (measured by undergraduate GPA adjusted for college quality) was a strong predictor of performance depending on branch cluster.

Finally, we emphasize that the predictor measures used in this project were originally developed to augment the selection process of 4-year ROTC scholarship recipients as predictors of general performance. Therefore, results showing that they support differential validity and have utility for classification purposes supports expectations that non-cognitive measures could be created to support classification goals via their potential to provide differential validity effects by officer branch. Furthermore, we expect that the use of these predictor measures represents on "lower bound" on the range of results that could be obtained by creating and using a battery of non-cognitive measures that are explicitly created to provide differential validity effects over branches.

Joint Predictor-Criterion Space Equivalence

A potential threat to the utility of these analyses is that the performance composite chosen to validate the predictor measures may have an undue influence on our results. Therefore, we explored the Joint Predictor-Criterion Space Equivalence using the key performance composites as criteria. Our results show that the use of each of these performance composites resulted in highly correlated predictor composites so that the specific performance composite used to develop branch assignment algorithms would have minimal on individual branch assignment decisions in an operational environment. This result is important because it allays concerns that assignment effects are highly specific to the performance composite that is being utilized to develop the predictor composites.

This equivalence may reflect the effect of a general factor of performance and mirrors demonstrations showing the substitutability of performance and knowledge-based criteria as the basis for the development cognitive ability composites (cf., Scholarios et al., 1994; Zeidner et al., 2003). From an applied perspective, this result is important because it reduces concerns that assignment effects are specific to the optimized performance composite (i.e., the Weighted 8-Factor composite) and highly specific to the use of this composite. In addition, the results in Table 31 indicate that the non-performance composites result in much different assignment decisions (i.e., the performance and non-performance criteria do not provide joint predictor-criterion space equivalence).

U.S. Army Officer Branch Assignment Implications

Application of a computer simulation revealed the extent to which the validity of performance predictions affects the extent to which predicted criterion levels can be improved by optimization. The simulation yielded substantial improvement to predicted job performance (over current assignment methods) for Military Intelligence, Signal Corps, Cyber, and Medical Service Corps branches. Moderate improvement in performance was found for six branches: Chemical, Air Defense, Ordnance, Transportation, Quartermaster, and Adjutant General.

However, the effects of limited validity were found in the Maneuver cluster (Infantry, Armor, and Aviation), which showed almost no improvement in performance as a result of optimization. Finally, the simulation was used to address a small number of potential assignment methods to illustrate its utility. We believe that application to a wider range of methods would establish its validity and lead to the development of new features to enhance its capability. We also acknowledge that this branch cluster might have been overly heterogeneous; this possibility suggests performance gains might have been realized if sufficient data had been available to compute results for each of these three branches. More generally, improving the validity with which performance and retention can be predicted will lead to improvements in the effectiveness of branch assignment methods.

Future Directions

The predictors used in this project were designed to predict overall officer performance and continuance. They were not developed specifically for the purpose of branch assignment. Despite this limitation, several of those predictors showed potential for differentially predicting performance across branch clusters (e.g., CBEF composites for Tolerance and Fitness, the LKT scales, and occupational interest measure). Therefore, it appears likely that larger gains in predicted performance would result from a predictor battery that is designed to emphasize and capitalize on differences across branches.

The key next steps are two-fold. The first step is to gather branch-specific information to aid in predictor development. Fortunately, ARI has recently conducted a large-scale job analysis of officer jobs and reported the results by branches and functional categories (B. Boyle, personal communication, November 16, 2018). Those results provide essential information about skills, abilities, and talents needed for effective performance in each branch. Boyle's research did not include occupational interest constructs and several of the constructs that were identified in the current project as being potentially useful (e.g., Fitness). Therefore, some supplemental information is needed to finalize branch-specific measurement plans.

The second step is to use the data collected in the current project to evaluate different approaches to keying and scoring the predictors. For example, the LKT showed some promise for differentiating branches. The LKT is currently scored with one key to predict overall officer performance. Analyses can be conducted with the current database to test ideas for modifying existing predictors. With these thoughts in mind, ARI has initiated a follow-on project to develop branch-oriented predictors and to continue the collection of in-unit performance ratings on junior officers.

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APPENDIX A
METHODS SUPPLEMENT

Data Screening and Cleaning Procedures

We screened all Junior Officer Survey (JOS) and Junior Officer Performance Rating Scale (JOPRS) responses for careless responding. For the JOS, we implemented a screening rule whereby we screened out respondents who left 10% or more of the individual JOS items blank. A 10% missing data rule is a common rule used in many ARI research projects. For the JOPRS, we implemented the following three screening rules, such that a record that flagged on any rule was eliminated:

- *Absolute missing data level*. Any rater who skipped four or more of the 14 (28.57%) performance rating scales was eliminated. This threshold was set, recognizing that some raters might be rating multiple ratees and may have simply left the item blank, instead of filling in the Cannot Rate response option due to their increased rating load. A later version of the JOPRS was shortened to include only eight, single-item performance rating scales. In these latter administrations, we also eliminated cases with three or more missing items.
- *Familiarity screen.* Raters used the following 4-point rating scale to describe their familiarity with the ratee's performance:
    1. Not enough to judge any aspect of the officer's performance
    2. Not enough to judge several aspects of the officer's performance
    3. Enough to judge most aspects of the officer's performance
    4. Enough to judge almost all aspects of the officer's performance

  Any rater who marked a "1" for familiarity was removed from the analysis sample. These raters had little to no useful knowledge to make valid ratings of the ratee.
- *Not Observed/Cannot Rate*. For each performance dimension, raters had the option of rating performance on a 7-point scale or indicating that they had not observed the behavior and could not rate the officer's performance for that dimension. Rather than screening out respondents who marked "2" for familiarity, we instead focused the third screening rule on "Not Observed/Cannot Rate" option. This decision allowed us to retain raters who were legitimately familiar with some, but not necessarily all, aspects of a ratee's performance. Specifically, we excluded raters who chose "cannot rate" for 50% or more of the JOPRS assessment in both its full and abbreviated versions. Thus, this rule allowed us to retain data from raters who had some useful knowledge about ratees, while excluding those who may have initially reported being familiar with a ratee's performance, but then reported being unable to rate a large proportion of the items.

In addition to these data quality screens, we screened out respondents that could not be linked back to the 2010-2016 ROTC Advanced Camp cohorts.

Computation of Predicted Interest-Branch Fit

We wanted to develop a way of capturing occupational interests of cadets and using those interests to predict the cadet's fit with occupational interests related to each branch. We drew on the wealth of occupational interest research to infer the cadet's occupational interests based on his/her college major. Specifically, we identified the occupational profile for each cadet's college major and used that to infer the cadet's occupation interests.

We created Predicted Interest-Branch Fit as an indicator of the match between the interest profiles of each officer's college major with the interest profile of the officer's current branch. Interest profiles were based on Holland's (1985) RIASEC vocational interests, which includes six interest dimensions (i.e., Realistic, Investigative, Artistic, Social, Enterprising, and Conventional). O*NET definitions of the six RIASEC constructs are shown in Table A.1. We chose this model because ratings on these dimensions are gathered by O*NET and were available for a wide variety of occupations and majors.

Table A.1. RIASEC Construct Definitions

Construct	Definition
Realistic	Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.
Investigative	Investigative occupations frequently involve working with ideas and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.
Artistic	Artistic occupations frequently involve working with forms, designs and patterns. They often require self-expression and the work can be done without following a clear set of rules.
Social	Social occupations frequently involve working with, communicating with, and teaching people. These occupations often involve helping or providing service to others.
Enterprising	Enterprising occupations frequently involve starting up and carrying out projects. These occupations can involve leading people and making many decisions. Sometimes they require risk taking and often deal with business.
Conventional	Conventional occupations frequently involve following set procedures and routines. These occupations can include working with data and details more than with ideas. Usually there is a clear line of authority to follow.

Source. Retrieved from O*NET Online https://www.onetonline.org/find/descriptor/browse/Interests/

RIASEC Profiles for Officers

We began by examining the frequencies of the various college majors chosen by officers. Officers were asked to select "major area of study" on the JOS. We found that while most officers selected three or fewer areas of study, some included up to 17. We assumed that those who had selected more than three may have misinterpreted the instructions and choose subjects for which they had taken courses, rather than their college major. Therefore, we limited the college major interest indicators to those who had chosen no more than three college majors.

Next, we mapped each individual college major to a corresponding Classification of Instructional Program (CIP) code. The CIP system is a taxonomy of various fields of study developed by the U.S. Department of Education's National Center for Education Statistics. Each field of study is tied to a code, which we used in our mappings of college majors. In turn, we used a crosswalk that mapped CIP codes to O*NET's Standard Occupational Classifications (SOCs), which we obtained from the O*NET Resource Center (National Center for O*NET Development, 2019). We then used a file of RIASEC ratings by SOC from the O*NET Resource Center to determine the interest profiles for each college major. In many cases, a single CIP code mapped on to multiple SOCs; therefore, RIASEC ratings were averaged across those multiple SOCs. For officers who selected more than one college major, RIASEC profiles were averaged across majors. https://www.onetonline.org/crosswalk/CIP/). We then used a file of RIASEC ratings by SOC from the O*NET Resource Center to determine the interest profiles for each college major.

RIASEC Profiles for Branches

We wanted to correlate officers' RIASEC profiles with each branch's RIASEC profile. Although we tried to map the branches to the CIP codes in the same manner described above, we found that the military-specific branches (e.g., Infantry) did not map well or were not present in the O*NET mapping. With permission, we obtained access to RIASEC ratings gathered for military occupations for the Careers in The Military (CITM) project (J. Bayer, personal communication, August 13, 2019), which allowed us to more accurately map each branch to one or more SOCs and corresponding RIASEC ratings. Table A.2 shows the interest profiles for each branch. The profiles make logical sense. For example, scores on Investigative interests are high for Military Intelligence, Medical Service Corps, Corps of Engineers, and Cyber branches. All branches have low ratings on Artistic interest.

Table A.2 Mean RIASEC Profiles by Branch

Branch	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
Cyber	3.40	5.27	1.07	2.80	3.47	4.13
Signal Corps	6.00	3.50	1.06	1.67	2.44	3.83
Finance Corps	1.56	3.67	1.00	2.33	4.00	6.56
Transportation Corps	2.83	3.83	1.00	2.33	4.17	4.50
Quartermaster Corps	4.43	2.57	1.19	2.38	2.76	5.05
Adjutant General Corps	1.00	2.67	1.00	6.33	5.67	3.67
Medical Service Corps	2.69	5.98	1.24	5.07	3.97	3.25
Field Artillery	4.00	3.67	1.00	3.33	6.00	3.00
Infantry	4.00	3.33	1.00	3.00	6.67	1.67

Table A.2 (Continued)

Branch	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
Ordnance Corps - Maintenance and Munitions Management	5.00	2.33	1.00	3.67	5.33	4.67
Ordnance Corps - Explosive Ordnance Disposal	5.00	3.33	1.00	3.00	5.33	2.67
Military Intelligence Branch	1.33	6.67	1.00	3.67	4.67	3.00
Corps of Engineers	4.75	5.50	1.37	1.63	2.79	3.29
Military Police Corps	3.27	4.27	1.20	4.13	4.33	3.07
Aviation	5.33	3.85	1.27	2.50	2.64	3.95
Chemical Corps	2.00	3.33	1.00	4.67	5.00	3.67
Armor	3.00	4.67	1.00	3.33	6.00	2.00
Air Defense Artillery	4.00	3.67	1.00	3.33	6.00	3.00

Source. Beyer, J., McLean, K., & Salyer, S. (2017). *Careers in the military taxonomy and website update report.* Unpublished manuscript.
Note. The scale ranged from 1 = low to 7 = high.

Predicted Interest-Branch Fit

To create the fit indicators, we computed correlations between each officer's major-based RIASEC profile with the RIASEC profile for each branch; higher correlations indicate closer profile matches. There is one fit score for each branch. To conserve degrees of freedom, we only included the fit score for the officer's current branch in validation analyses (i.e., if the officer is currently an Infantry officer, only the officer's fit score with Infantry is included). Other analyses such as branch preference modelling included the full set of predicted interest-branch fit scores.

Computation of the College Quality Index

We mirrored the approach used by Koch and colleagues to create the College Quality Index (2013). These authors collected a wide variety of college data from the National Center for Educational Statistics (NCES) including: 25th and 75th percentile scores for the SAT and ACT for entering students, selection rate, enrollment rate, open admission policy, graduation rate, expenditures on undergraduate instruction, and federal grants received by each college. These authors examined correlations between the college variables and GPA and reported that five were significantly correlated with GPA: (a) 25th percentile ACT score (SAT score when ACT was not available), (b) open admission policy (whether the college admits any student who applies), (c) freshman retention rate (percent of full-time freshman students who return to the college in fall of their sophomore year), (d) graduation rate (proportion of students who complete their intended degree within 150% of the expected time), and (e) expenditure on undergraduate instruction (total amount spent on instruction per full-time undergraduate student).

NCES Data Download and Cleaning

We obtained college quality indicators from the online Integrated Postsecondary Education Data System (National Center for Education Statistics, 2019). Annual college quality data were pulled from years 2007 to 2016, to match the years in which our sample of officers attended college. The NCES college data contained 7,121 unique colleges, which comprised a wide variety of college types. We wanted to create a database including only colleges like those attended by officers in our sample. Therefore, we retained only 4-year schools, and removed graduate school-only institutions and 2-year only institutions. This exclusion criterion removed 3,886 institutions from the database. We also retained only colleges that had academic offerings; colleges with only occupational offerings were removed from the database. This exclusion criterion removed a further 2,086 institutions. Because there were overlapping schools across these exclusion criteria, 4,211 unique institutions were removed from the database. Finally, manual inspection of the data revealed that schools with a total undergraduate population of less than 100 were fundamentally different than the rest of the college quality database. These 393 schools were predominantly professional schools (i.e., cosmetology and massage therapy schools), which were also removed. In the end, a total of 2,517 institutions were included in the final college quality sample. None of the schools attended by individuals in the JOS database were removed by these exclusion criteria.

Calculation of College Quality Metric

Each of the five individual college quality indicators (ACT or SAT 25th percentile, retention rate, graduation rate, open admission policy, and undergraduate expenditure) was scored such that higher scores reflected higher college quality. We standardized all indicators within year, except for open admission policy. Then, we averaged all five indicators across years, creating five college quality indicator scores for each college. Open admissions policy was coded as "Yes" = 0 or "No" = 1 and averaged. Thus, a mean score of "1" on open admission policy indicated the school continuously had no open admissions, a "0" indicated the school continuously had open admissions, whereas scores in between "0" and "1" indicated a change in policy. All indicators displayed less than 10% missing data except for ACT/SAT 25th percentile, which had 41% missing values.

To weight each of the five individual quality indicators into an index of overall college quality, we used effective weighting (cf. Wang & Stanley, 1970). Effective weighting takes into account each variable's variance and covariance across all variables, so that each variable contributes equally to the overall composite variance. An overall college quality score was then calculated for each college that contained at least three of the five individual quality indicators. The overall college quality metric was then standardized. Each officer in our database received the CQM score associated with his or her undergraduate college.

Predictor and Composite Supplementary Information

The following tables contain supplementary material related to the development of the predictor and criterion composites.

- Table A.3 contains the Standardized factor loadings for Model 3, which were used to develop the predictor composites and corresponds to the best fitting model based on the fit indices.
- Tables A.4 and A.5 reports between group differences across the 14 predictor composites for gender (Table A.4) and race (Table A.5).
- Table A.6 documents the items and scales that loaded on each of the performance composites and their factor loadings.
- Table A.7 documents the items and scales that were mapped onto the attitudinal composites.
- Tables A.8 and A.9 provide subgroup differences for the performance and attitudinal composites

Table A.3. Standardized Loadings from the Final Confirmatory Factor Analysis (Model 3)

Scale	Factors								
	PL	ACH	PHYS	FIT[a]	TOL	HON[a]	WVI	LKT-C	LKT-S
Cadet Background and Experience Form (CBEF)									
Peer Leadership	.64								
Written Communication		.34							
Oral Communication		.33							
Achievement		.30							
General Self-Efficacy		.30							
Tolerance for Injury			.46						
Fitness Motivation			.44						
Army Identification				.36					
Past Withdrawal Propensity				.35					
Stress Tolerance					.32				
Hostility Toward Authority					.30				
Response Distortion						.16			
Work Values Inventory (WVI)									
Profile Similarity Index (PSI)[b]							.39		
Leader Knowledge Test (LKT)									
Characteristics Score								.25	
Skills Score									.25

Note. Factor abbreviations are: PL = Peer Leadership, ACH = Achievement Factor, PHYS = Physical Factor, FIT = Fit/Commitment Factor, HON = Honesty Factor, WVI=Work Values Inventory, LKT-C = LKT Characteristics Score; LKT-S = LKT Skills Score. LKT loadings are from a separate CFA.
a. Reverse-scored

Table A.4. Final Predictor Score Descriptive Statistics by Gender

Predictor Composite		Males			Females			Cohen's *d*
		n	*M*	*SD*	*n*	*M*	*SD*	Male-Female
Cadet Outcome Metric Score (OMS)								
1	Academic Component Score	14,648	.30	.89	3,596	.37	.85	**-0.08**
2	Leadership Component Score	14,648	.44	.86	3,596	.32	.88	**0.13**
3	Physical Component Score	14,407	.29	.83	3,489	.27	.88	0.02
Cadet Background and Experience Form (CBEF)								
4	Achievement Composite	14,199	.10	.87	3,602	.12	.90	-0.02
5	Fit/Commitment Composite	14,199	.16	.81	3,602	.01	.84	**0.18**
6	Response Distortion Scale	14,199	-.05	.95	3,602	.04	1.04	**-0.09**
7	Peer Leadership Scale	14,199	.07	.97	3,602	.11	1.01	**-0.04**
8	Fitness Composite	14,199	.26	.76	3,602	-.27	.77	**0.69**
9	Tolerance Composite	14,199	.09	.79	3,602	.01	.82	**0.10**
Work Values Inventory (WVI)								
10	Profile Similarity Index (PSI)	14,199	.12	.66	3,602	.00	.64	**0.18**
Leader Knowledge Test (LKT)								
11	Characteristics Score	14,199	.01	.39	3,602	.03	.31	**-0.07**
12	Skills Score	14,199	.01	.38	3,602	.02	.34	-0.03
Other Predictors								
13	Predicted Interest-Branch Fit	7,684	.42	.41	1,454	.32	.46	**0.23**
14	College Quality Index	9,323	.69	.83	2,323	.65	.87	**0.05**

Note. Negative means indicate lower scores on the predictor variable. d = Cohen's d; standardized mean difference between Male and Female samples. Positive d values indicate higher scores for Males, and negative d values indicate higher scores for Females. Cohen's d values that are boldface represent differences significant at $p < .05$.

Table A.5. Final Predictor Score Descriptive Statistics by Race/Ethnicity

Predictor Composite		White			Black			Hispanic			Cohen's *d*	
		N	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	White-Black	White-Hispanic
Outcome Metric Score												
1	Academic Component Score	13,391	.36	.87	1,478	-.02	.94	1,599	.23	.89	**0.44**	**0.15**
2	Leadership Component Score	13,391	.47	.86	1,478	.15	.90	1,599	.29	.86	**0.38**	**0.22**
3	Physical Component Score	13,145	.32	.84	1,439	.12	.89	1,566	.19	.86	**0.24**	**0.16**
Cadet Background and Experience Form (CBEF)												
4	Achievement Composite	13,038	.09	.85	1,466	.34	.92	1,559	.27	.92	**-0.29**	**-0.22**
5	Fit/Commitment Composite	13,038	.14	.81	1,466	.17	.86	1,559	.24	.83	-0.04	**-0.13**
6	Response Distortion Scale	13,038	-.15	.80	1,466	.52	1.41	1,559	.40	1.38	**-0.77**	**-0.63**
7	Peer Leadership Scale	13,038	.07	.96	1,466	.25	1.02	1,559	.15	1.01	**-0.18**	**-0.08**
8	Fitness Composite	13,038	.21	.79	1,466	-.07	.78	1,559	.13	.78	**0.34**	**0.09**
9	Tolerance Composite	13,038	.05	.76	1,466	.29	.91	1,559	.25	.90	**-0.32**	**-0.26**
Work Values Inventory												
10	Profile Similarity Index (PSI)	13,038	.13	.66	1,466	-.01	.62	1,559	.09	.61	**0.21**	**0.06**
Leader Knowledge Test												
11	Characteristics Score	13,038	.02	.37	1,466	.00	.40	1,559	-.01	.33	**0.06**	**0.09**
12	Skills Score	13,038	.03	.36	1,466	-.02	.38	1,559	-.04	.36	**0.15**	**0.20**
Other Predictors												
13	Predicted Interest-Branch Fit	6,759	.40	.42	754	.42	.41	792	.40	.42	-0.04	0.02
14	College Quality Index	8,539	.76	.78	973	.13	.71	1,005	.43	.85	**0.82**	**0.42**

Note. Negative means indicate lower scores on the predictor variable. *d* = Cohen's *d*; standardized mean difference between White and minority samples. Positive *d* values indicate higher scores for Whites, and negative *d* values indicate higher scores for Blacks and Hispanics. Cohen's *d* values that are boldface represent differences significant at $p < .05$.

Table A.6. Final Performance Criterion Composites and Component Measures

Criterion Composite	Items Included [Measure]	Factor Loading
1. Branch-Specific Technical Task Proficiency	• Made the Commandant's List (i.e., ranked in top 20%) of BOLC B class [JOS]	**.16**
	• Number of Additional Skill Identifiers (ASI) [JOS]	**.35**
	• Performs branch-specific technical and tactical duties proficiently [JOPRS]	**.24**
2. Army-Wide Technical Task Proficiency	• Completed Ranger Training [JOS]	**.18**
	• Completed Airborne School [JOS]	**.20**
	• Performs core warrior tasks required of all personnel proficiently [JOPRS]	**.57**
3. Written and Oral Communication Task Proficiency	• Communicates clearly and persuasively in writing [JOPRS]	**.48**
	• Is effective in oral discourse; listens actively; speaks clearly and persuasively [JOPRS]	**.35**
4. Demonstrating Effort	• Count of merit and valor awards [Archival]	**1.00**
	• Demonstrates effort and willingness to keep working under adverse conditions [JOPRS]	**.07**
5. Maintaining Personal Discipline	• Formally counseled about behavior or discipline (outside of routine counseling) [JOS]	**.44**
	• Formally counseled about unsatisfactory performance [JOS]	**.79**
	• Demonstrates self-control and personal discipline on the job; provides leader presence and composure [JOPRS]	**.06**
6. Maintaining Physical Fitness, Strength, and Weight	• Latest Army Physical Fitness Test (APFT) score [JOS]	**.57**
	• Maintains physical fitness, strength, and weight effectively [JOPRS]	**.61**
7. Leadership and Supervision	• Received a nominative assignment (as an aide to a general officer) [JOS]	**.22**
	• Recommended for command on the OER [JOS]	**.63**
	• Recommended for S3 on the OER [JOS]	**.44**
	• Served as a formal briefing officer to higher command echelons [JOS]	**.40**
	• Fosters teamwork and enthusiasm for accomplishing objectives; supports and empowers subordinates [JOPRS]	**.09**
	• Provides structure, direction, training, and instruction to subordinates and informs them of things they should know [JOPRS]	**.11**
	• Represents the army effectively in cross-cultural, multinational, or joint-forces settings [JOPRS]	**.13**
8. Management and Administration	• Makes sound decisions and adapts strategies to changing situations [JOPRS]	**.18**
	• Plans, coordinates, staffs and monitors unit activities, using resources effectively to accomplish goals [JOPRS]	**.25**
	• Performs day-to-day administrative tasks, keeping accurate records and reports [JOPRS]	**.28**
	• Innovates solutions to problems [JOPRS]	**.24**

Table A.6. (Continued)

Criterion Composite	Items Included [Measure]	Factor Loading
9. Overall Performance: Weighted 8-Factor Composite[a]	• Weighted average of all eight JOPRS scales	--
10. Can-Do	• Performs branch-specific technical and tactical duties proficiently [JOPRS]	**.24**
	• Performs core warrior tasks required of all personnel proficiently [JOPRS]	**.32**
	• Completed Ranger Training [JOS]	**.37**
	• Completed Airborne School [JOS]	**.54**
	• Number of Additional Skill Identifiers (ASI) [JOS]	**.59**
11. Will-Do	• Made the Commandant's List (i.e., ranked in top 20%) of BOLC B class [JOS]	**.14**
	• Number of retests in BOLC B [JOS]	**.06**
	• Communicates clearly and persuasively in writing [JOPRS]	.11
	• Is effective in oral discourse; listens actively; speaks clearly and persuasively [JOPRS]	**.15**
	• Demonstrates effort and willingness to keep working under adverse conditions [JOPRS]	**.21**
	• Demonstrates self-control and personal discipline on the job; provides leader presence and composure [JOPRS]	**.21**
	• Maintains physical fitness, strength, and weight effectively [JOPRS]	**.18**
	• Plans, coordinates, staffs and monitors unit activities, using resources effectively to accomplish goals [JOPRS]	**.14**
	• Performs day-to-day administrative tasks, keeping accurate records and reports [JOPRS]	.11
	• Innovates solutions to problems [JOPRS]	**.17**
	• Fosters teamwork and enthusiasm for accomplishing objectives; supports and empowers subordinates [JOPRS]	**.19**
	• Provides structure, direction, training, and instruction to subordinates and informs them of things they should know [JOPRS]	**.17**
	• Represents the army effectively in cross-cultural, multinational, or joint-forces settings [JOPRS]	**.17**
	• Makes sound decisions and adapts strategies to changing situations [JOPRS]	**.20**
	• Received a nominative assignment (as an aide to a general officer) [JOS]	**.20**
	• Recommended for command on the OER [JOS]	**.63**
	• Recommended for S3 on the OER [JOS]	**.51**
	• Recommended for XO on the OER [JOS]	**.57**
	• Served as a formal briefing officer to higher command echelons [JOS]	**.35**

Note. JOS = Junior Officer Survey; JOPRS = Junior Officer Performance Rating Scales.
[a] Developed using a weighted average of JOPRS scales, not CFA loading.

Table A.7. Final Attitudinal Criterion Composites and Component Measures from Junior Officer Survey (JOS) Items

Criterion Composite	Measures/Items Included
Satisfaction Criterion	
Branch Satisfaction	• How satisfied are you with your current branch? (1 = Very satisfied, 2 = Somewhat satisfied, 3 = Neither satisfied nor dissatisfied, 4 = Somewhat dissatisfied, 5 = Very dissatisfied) • Please indicate the reason(s) you recycled in BOLC-B for your current branch? (Lack of interest in branch assignment) • At the time you came closest to leaving the Army, why did it seem likely that you would have left? (I was not satisfied with my branch, I could not get the branch I wanted) • Please indicate the reason(s) you plan to leave the Army before reaching your retirement point (Could not get the branch I wanted; Dissatisfied with branch)
Continuance Intentions Criteria	
Career Ambition	• At the time you came closest to leaving the Army as an officer, why did it seem likely that you would have left? (I was dissatisfied with the potential for promotion) • What is the highest rank you think you will achieve in your Army career? • What is the highest level at which you would like to command during your Active Army career? • Please indicate the reason(s) you plan to leave the Army before reaching your retirement point (Have achieved what I wanted in an Army career; Lack of promotion potential)
Career Intentions	• During the past year, how frequently have you thought about leaving the Army? (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Very often) • Since becoming an officer, how close have you ever come to leaving the Army? (1 = Extremely close, 2 = Very close, 3 = Moderately close, 4 = Slightly close, 5 = Not at all close) • Since becoming an officer, how often have you come at least moderately close to leaving the Army? (1 = Very often, 2 = Often, 3 = Sometimes, 4 = Seldom, 5 = Never) • How many years, in total, do you plan to stay in the Army as an Active Duty officer? • Will you stay in the Army until retirement? (1 = Definitely, 2 = Probably, 3 = Undecided, 4 = Probably not, 5 = Definitely not) • Have you submitted a separation or resignation request? (Not yet, but I plan to submit a request in time to separate after my current ADSO ends; Yes, I have submitted a request and I plan to separate after my current ADSO ends; I do not plan to submit a request in the near future, because I expect to continue my Army service beyond my current ADSO) • Please indicate the reason(s) you plan to leave the Army before reaching your retirement point (Not applicable, I plan to stay until my retirement point) • At the time you came closest to leaving the Army as an officer, why did it seem likely that you would have left? (Select ALL that apply.): Not applicable, it has always seemed unlikely that I would leave the Army; I had trouble adjusting to Army life; I needed/wanted to live in a different location; I was being treated unfairly by my supervisor(s); I was being treated unfairly by my peers; I thought my financial prospects were better outside the Army; I felt that the Army life was too mentally demanding and stressful; I could not get graduate education

Table A.8. Gender Differences for Performance and Attitudinal Criterion Composites

Criterion Composite		Males			Females			Cohen's *d*
		n	*M*	*SD*	*n*	*M*	*SD*	*Male-Female*
Performance Dimensions								
1	Branch-Specific Technical Task Proficiency	2,262	-.03	.75	451	-.19	.70	**0.22**
2	Army-Wide Technical Task Proficiency	2,262	.02	.64	451	-.17	.61	**0.31**
3	Written and Oral Communication Task Proficiency	2,262	-.03	.57	451	-.01	.54	-0.04
4	Demonstrating Effort	2,262	-.09	.99	451	-.17	.90	0.09
5	Maintaining Personal Discipline	2,262	.00	.78	451	.06	.63	-0.08
6	Maintaining Physical Fitness, Strength, and Weight	2,262	.02	.68	451	.02	.69	-0.01
7	Leadership and Supervision	2,262	-.06	.74	451	-.17	.76	**0.15**
8	Management and Administration	2,262	-.04	.57	451	-.06	.53	0.05
Key Performance Composites								
9	Overall Performance: Weighted 8-Factor Composite	2,262	-.03	.49	451	-.08	.45	0.10
10	Can-Do	2,262	.03	.71	451	-.33	.63	**0.51**
11	Will-Do	2,262	.00	.72	451	-.26	.75	**0.36**
12	Mean Supervisor Rating (Reduced JOPRS)	1,050	4.77	1.20	172	4.93	1.18	-0.13
Satisfaction Composite								
13	Branch Satisfaction	2,014	1.59	.58	407	1.62	.55	-0.05
Continuance Intentions Composites								
14	Career Ambition	1,974	1.61	.52	401	1.56	.52	0.10
15	Career Intentions	1,977	2.56	.86	401	2.47	.83	0.10

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. *d* = Cohen's *d*; standardized mean difference between males and females. Positive *d*-values indicate higher scores for males, and negative *d*-values indicate higher scores for females. *d*-values are not provided for any comparisons with a subgroup sample size smaller than 30. Bolded values indicate significant differences ($p < .05$).

Table A.9. Race/Ethnicity Differences for Performance and Attitudinal Criterion Composites

	Criterion Composite	White			Black			Hispanic			Cohen's *d*	
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	White–Black	White–Hispanic
	Performance Dimensions											
1	Branch-Specific Technical Task Proficiency	2,068	-.06	.74	192	-.05	.80	211	.03	.69	-0.01	-0.12
2	Army-Wide Technical Task Proficiency	2,068	-.01	.65	192	-.05	.63	211	.06	.61	0.08	-0.10
3	Written and Oral Communication Task Proficiency	2,068	-.02	.57	192	-.06	.55	211	-.03	.59	0.08	0.01
4	Demonstrating Effort	2,068	-.13	.98	192	.04	.99	211	.00	.95	**-0.17**	-0.13
5	Maintaining Personal Discipline	2,068	.02	.73	192	-.09	.93	211	.06	.64	**0.15**	-0.06
6	Maintaining Physical Fitness, Strength, and Weight	2,068	.01	.69	192	.10	.66	211	.07	.62	-0.13	-0.10
7	Leadership and Supervision	2,068	-.09	.75	192	-.02	.78	211	.00	.74	-0.09	-0.11
8	Management and Administration	2,068	-.04	.56	192	-.05	.55	211	-.04	.54	0.01	0.01
	Key Performance Composites											
9	Performance Composite: Weighted 8-Factor Composite	2,068	-.05	.48	192	-.02	.53	211	.02	.45	-0.06	-0.13
10	Can-Do	2,068	-.02	.71	192	-.07	.72	211	.01	.71	0.06	-0.04
11	Will-Do	2,068	-.04	.73	192	-.08	.78	211	-.04	.73	0.06	-0.00
12	Mean Supervisor Rating (Reduced JOPRS)	956	4.81	1.19	77	4.63	1.27	89	4.73	1.15	0.15	0.07
	Satisfaction Composite											
13	Branch Satisfaction	1,841	1.60	.59	173	1.55	.48	191	1.61	.58	0.10	-0.01
	Continuance Intentions Composites											
14	Career Ambition	1,801	1.57	.52	172	1.80	.50	187	1.68	.52	**-0.43**	**-0.22**
15	Career Intentions	1,803	2.51	.85	172	2.79	.89	188	2.63	.89	**-0.33**	-0.14

Note. Performance factors were standardized with a mean of zero and a standard deviation of 1.00 on the Active Duty Sample. Negative means indicate lower scores on the criterion variable. *d* = Cohen's *d*; standardized mean difference between subgroups. Positive *d*-values indicate higher scores for White officers, and negative *d*-values indicate higher scores for Black or Hispanic officers. Cohen *d*-values are not provided for any comparisons with a subgroup sample size smaller than 30. Bolded values indicate significant differences ($p < .05$).

APPENDIX B
RETENTION SUPPLEMENT

We examined the validity of the pre-commissioning and non-cognitive predictor composites against retention metrics for 18,926 active duty officers who had attended the ROTC Advanced Camp between 2010 and 2016. Retention rates for this sample were consistent with previous results indicating a steep decline in officer retention after these individuals had fulfilled their ADSOs (Colarusso et al., 2011). For our dataset, officer retention was nearly 100% for the two most recent cohorts (i.e., only 4 of the 5,069 officers in our database for these cohorts had separated from the military). However, retention dropped to 68% and 78% for the two most mature cohorts (i.e., the 2010 and 2011 cohort with five or more years of time in service). Across the seven ROTC Advanced Camp cohorts, the retention rate was approximately 90%. This overall result suggests that officer separation carries a low base rate and will be difficult to predict.

Consistent with the above expectation and prior research (Mount et al., 2000; White et al., 2001; Zaccaro et al., 2012), our correlation and regression analyses indicated only modest levels of validity against the continuance criteria for the pre-commissioning and non-cognitive predictor composites. These analyses are summarized below.

Background

The U.S. Army makes a substantial investment in the training of junior officers, and retention of high-performing officers is critical (Colarusso et al., 2010; Mattock et al., 2014). However, retention has been a difficult criterion to predict (Mount et al., 2000; White et al., 2001; Zaccaro et al., 2012). There are many potential reasons for leaving an organization, and the base rate for separation can be low, especially for newly commissioned officers. Retention results are known to vary across populations (i.e., officers versus enlistees; military versus civilian), and over time due to specific changes in organizational policy intended to enhance retention as well as the overall performance of the U.S. economy.

Retention within the U.S. Army officer corps has been shown to vary depending upon commissioning source. Colarusso et al. (2010) reported that retention rates start dropping between three to five years of service as officers reach their ADSO. However, they also found that officers who had received 4-year ROTC scholarships or been commissioned through USMA left the Army at much higher rates than officers commissioned through the Officer Candidate School or through ROTC with no scholarship.

Non-cognitive measures tend to show a modest, but promising relationships with retention and incremental validity effects beyond *g* for predicting retention/attrition criteria (Mount et al., 2000; White et al., 2001; Zaccaro et al., 2012). For example, in Project A, White et al. (2001) found that the Adjustment, Physical Condition, and Dependability scales on the Assessment of Background and Life Experiences (ABLE) yielded small, but significant correlations with attrition (r's = -.13, -.09, and -.08, respectively, n = 27,610). More extensive modelling of attrition showed that ABLE screening was most noticeable for particularly low ABLE scores. That is, Soldiers who had very low ABLE scores were more likely to leave.

More recently, Hughes et al. (2018) examined the validity of the Tailored Adaptive Personality Assessment System (TAPAS) for predicting different types of attrition in the enlisted ranks. While the Armed Forces Qualification Test (AFQT) predicted all types of attrition, some TAPAS facets predicted specific types of attrition. For example, TAPAS Physical Condition had a negative relationship with attrition for performance-related and medical/physical-related attrition. Regarding officer retention, in a study of long-term continuance among U.S. Army officers, Zaccaro and colleagues (2012) found that the best predictors of retention were marital status, complex problem solving, writing skills and creative thinking (all correlating about .40 with retention). Several personality scales (achievement orientation, stress tolerance, and tolerance for ambiguity) yielded smaller but significant correlations with retention. The point is that the validities of non-cognitive against retention outcomes are typically modest, but may provide incremental validity over cognitive measures.

Sample

We used the Active Duty sample (commissioned between 2011-2017, excluding direct commissioned officers)[1] to examine retention over a seven-year period. This sample contained data from the OMF that included separation date and separation program designators (SPDs). Any officer who did not have a separation date was identified as continuing or retaining their active duty status when the OMF data were extracted in 2017. To calculate retention, the OMF separation reason variable was used to create a dichotomous variable (0 or 1). An officer was coded as either current active duty (0), or separated from active duty (1). If the reason for separation was outside of the officer's control (i.e., injury or personal matter), then the officer's separation code was set to missing. In total, we had useable data for 18,926 officers.

Descriptive Statistics for Retention Criterion Scores

Table B.1 shows the overall number of officers with valid separation data (*n* = 18,926). The overall retention rate for those officers across cohorts was 90%. However, there was considerable variability across cohort years. Virtually no officers from the two most recent cohorts (2015 and 2016) had left. Retention dropped to 68% for the cohort that attended Advanced Camp in 2010. That cohort would have been commissioned in 2011. As mentioned, these data were extracted in 2017, six years after commissioning of this cohort and beyond their initial ADSOs. The 2012 Advanced Camp cohort would have begun reaching their ADSOs in 2017 and consequently there was a steep drop in retention between the 2013 and 2012 Advanced Camp cohorts. These data are consistent with prior findings. For example, Colarusso et al. (2011) found that ROTC officer retention for FY96 was over 85% at four years of service and dropped steeply thereafter.

[1] Direct commissioned branches have special requirements, and these officers commissioned are not a part of the branching process. Therefore, they were excluded from the retention analyses.

Table B.1. Descriptive Statistics for Retention by Demographic Subgroups and Cohort

	n	% Retained	Cohen's *d*
Overall	18,926	90	
Advanced Camp Cohort Year			
2010	2,188	68	
2011	3,061	78	
2012	2,700	88	
2013	2,719	95	
2014	2,821	99	
2015	2,943	100*	
2016	2,126	100*	
Gender			
Male	15,438	91	
Female	3,276	87	**0.12 (M-F)**
Race/Ethnicity			
White	13,656	89	
Black	1,603	93	**-0.11 (W-B)**
Hispanic	1,652	94	**-0.14 (W-H)**

Note. The label " % Retained" is the percent of officers in the Active Duty sample who were still active duty with 6-84 months of time in service. Missing data fields resulted in sample sizes for the demographic (Gender/Race/Ethnicity) and descriptive (Advanced Camp Cohort Year) variables not summing to the Overall sample size. Cohen's *d* was computed as the standardized mean difference between male/female and White/Black/Hispanic samples. Positive Cohen *d*-values indicate higher retention for the focal group (M), while negative Cohen's *d*-values indicate lower retention for the focal group (W). Bolded values indicate significant differences ($p < .05$).
*Four officers had attrited from 2015 cohort (rounds to 100%) and no officers had left the 2016 cohort.

Table B.1 also shows the retention percent by gender and race/ethnicity. As shown, retention rates were higher for males compared to females and for minorities compared to Whites. Table B.2 reports the percent retained by branch cluster across all cohorts. Differences among the clusters were small (96-98%). However, branch information was missing from the data file for 1,748 officers, and retention for that group was very low (19%). Eighty-one percent of officers with missing branch cluster information were from the 2010 and 2011 Advanced Camp cohorts, which were both cohorts with lower retention rates than the more recent Advanced Camp cohorts. We surmise that the missing branch information was likely related to the attrition of those officers.

Table B.2. Descriptive Statistics for Retention by Branch Cluster

Branch Cluster	*n*	% Retained
Maneuver	3,639	98
Maneuver Support	2,369	98
Fires	1,804	97
Intelligence, Surveillance, and Reconnaissance	2,305	98
Network and Space Operations	1,624	97
Health Services	972	98
Integrated Logistics Corps/Soldier Support	4,465	96
Missing	1,748	19
Total	18,926	90

Active Duty Validation Results

We first examined retention using the bivariate correlational analyses. For the regression-based analyses, retention was used as the criterion (coded positively such that retention = 1, separation = 0). For the full list of predictors, refer to Table 9.

Bivariate Correlations

Table B.3 presents correlations between all predictors and Active Duty Sample criteria, overall and by branch cluster. In general, correlations between predictors and retention were small in magnitude. In the Active Duty Sample, the strongest predictors of retention were CBEF Fit/Commitment and Tolerance Composites, which are described in Tables 8 and 9. Table B.3 also presents the predictor–criterion correlation matrices for the by-branch cluster samples. Given the low base rates of attrition within branch, branch-specific results need validation in future retention research. For example, the Academic OMS was a significant negative predictor of retention for four branch clusters, whereas it was non-significant predictor for three other branch clusters. Similarly, CBEF Tolerance was a significant positive predictor of retention for two branch clusters, whereas it was a non-significant predictor for four other branch clusters. To be cautious, these conclusions may not be robust over time and samples.

Table B.3. Bivariate Validities: Retention Criterion Overall and by Branch Cluster

Criterion: Retention	Predictor													
	Cadet Outcome Metric Score (OMS)			Cadet Background & Experience Form (CBEF)						WVI	Leader Knowledge Test (LKT)		Other	
	ACS	LCS	PCS	AC	FC	RD	PL	F	T	PSI	CH	SK	FIT	CQI
Overall	**-.03**	**.02**	-.00	**.08**	**.10**	**.04**	**.06**	**.08**	**.10**	**.06**	.01	-.00	-.01	-.00
Functional Category/Branch Cluster														
Maneuver, Fires, & Effects														
Maneuver	**-.04**	-.03	-.02	-.00	.01	.03	-.00	-.00	.03	-.00	-.00	-.02	-.04	**.05**
Infantry Branch	-.05	-.01	-.01	.02	.04	.04	.01	.03	.04	.03	-.01	-.02	-.03	.04
Maneuver Support	**-.05**	-.03	-.01	.04	**.07**	.03	.01	.04	**.07**	.02	-.00	.02	-.00	-.05
Fires	**-.09**	**-.07**	-.05	.01	.03	.04	.02	-.00	-.00	.01	-.04	-.04	.02	.02
Operations Support														
Intelligence, Surveillance, & Reconnaissance (ISR)	-.02	-.01	-.01	-.00	.02	.01	-.01	.01	.03	-.04	-.01	.02	.04	-.02
Network and Space Operations	-.00	-.01	.01	.01	.02	-.00	-.00	-.00	.02	-.04	-.00	-.00	.06	-.03
Force Sustainment														
Health Services	.04	.02	-.01	.06	.05	-.00	.04	.05	.05	.05	-.01	-.04	.07	-.05
Integrated Logistics Corps / Soldier Support	**-.06**	-.01	-.00	.05	**.07**	**.06**	.03	**.04**	**.08**	.03	.01	.03	-.02	**-.04**
Branch Cluster Missing	.05	**.06**	.04	**.07**	**.07**	-.01	.04	.05	.04	-.01	.01	.02	NA	**.24**

Note. Overall sample *n* = 9,160–17,120, by cluster sample *n*'s: Maneuver = 1,917 – 3,335, Infantry Branch = 1,020–1,751, Maneuver Support = 1,377–2,131, Fires = 1,005–1,669, ISR = 1,227–2,132, Network and Space Operations = 873–1,451, Health Services = 485–895, Integrated Logistics Corps / Soldier Support = 2,276–4,030, Branch Cluster Missing = 122–1526. ACS = Academic Component Score. LCS = Leadership Component Score. PCS = Physical Component Score. AC = Achievement. FC = Fit/Commitment. RD = Response Distortion. PL = Peer Leadership. F = Fitness. T = Tolerance. WVI PSI = Work Values Inventory – Profile Similarity Index. CH = Characteristics. SK = Skills. FIT = Predicted Interest-Branch Fit. CQI = College Quality Index. Bolded values indicate statistical significance ($p < .05$).

Regression Analyses

We used logistic regression to predict the dichotomous retention criterion. The logistic regression analyses require complete cases on all the predictors. To preserve sample size, we dropped two predictors (College Quality Index, Predicted Interest-Branch Fit) for which we had less data. Nonetheless, the overall *n* for logistic regression analyses (*n* = 15,151) was smaller than the overall *n* of the Active Duty sample (*n* = 18,926) reported in Table B.1.

We used both hierarchical multiple regression analyses as well as Bayesian Model Averaging (BMA), which we describe below.

Hierarchical Multiple Regression

Table B.4 presents hierarchical logistic regression results for the Active Duty Sample and by-rank on the retention criterion. Because logistic regression precludes the direct estimation of a multiple *R* statistic, we used McFadden's Pseudo-*R* (McFadden, 1974) to evaluate overall prediction in the logistic regression models. Although there are several Pseudo-*R* metrics for logistic regression, McFadden's *R* (also called the likelihood ratio index) has been found to be the least sensitive to changes in the base-rate of the dichotomous criterion variable (Menard, 2000; Sharma et al., 2011). Robustness to changes is particularly important for separation, given its relatively low base-rates across samples. McFadden's metric calculates *R* based on a ratio of the log-likelihood from the full model to that from an intercept-only model, and is calculated as:

$$\sqrt{\frac{-2(\ln L_0 - \ln L_M)}{-2\ln L_0}}$$

Where L_0 is the likelihood of the intercept-only model and L_M is the likelihood of the fitted model. Chi-square significance tests were also conducted on the null and residual deviance values to indicate if the full models fit significantly better than the Cadet OMS-only models.

Table B.4. Incremental Validity of New Predictors for Predicting Retention in the Active Duty Sample

Retention	*n*	Cadet Outcome Metric Score (OMS) Only			Cadet OMS + New Predictors			Δ *Pseudo R*	*Δ -2 LL*
		df	*Pseudo R*	*-2 LL*	*df*	*Pseudo R*	*-2 LL*		
Overall	15,151	3	.053	8684.06	12	.168	8461.84	.115	-222.22**
Lieutenants	10,329	3	.082	4005.80	12	.183	3897.75	.101	-108.05**
Captains	4,696	3	.091	3784.78	12	.172	3703.98	.081	-80.80**

Note. -2LL stands for -2 Log Likelihood. Pseudo *R* is calculated based on McFadden's likelihood ratio *R* (McFadden, 1974). Significant values indicate that the model with both the OMS and CBEF predictor fits better than the model with just the OMS predictors. Analysis conducted on Active Duty Sample using the retention criterion. * $p < .05$. ** $p < .01$. OMS Only includes the three OMS scores (Academic, Leadership, and Physical). New Predictors includes six CBEF composites, 2 LKT scores, and the WVI – Profile Similarity Index. Missing information resulted in rank sample sizes not summing to the Overall sample size.

Results in Table B.4 indicate that the new non-cognitive predictors significantly increased prediction beyond the Cadet OMS variables in overall, Lieutenant, and Captain samples. Increases in prediction, as quantified by changes in Pseudo-*R* values from the Cadet OMS only to the Cadet OMS + CBEF models, ranged from .081–.115.

Bayesian Model Averaging (BMA)

We used the same BMA procedures for the Active Duty Sample as were used for the Validation Sample in the body of the report. The major difference was that we used logistic regression rather than OLS regression to estimate regression coefficients and subsequent multiple correlations.

Table B.5 presents the BMA results for the retention criterion models for the Active Duty Sample (*n* = 15,151). Regarding OMS, which is currently used for selection and branching, the Academic Component had a 100% predictor criticality (PC) value and a negative average beta weight. This suggests that officers with higher Academic Component scores tended to leave.

Table B.5. Logistic Bayesian Model Averaging Results for Predicting Retention in the Active Duty Sample

Predictor		Retention	
		Active Duty Sample *n* = 15,151	
		$\bar{b}$	*PC*
Intercept		2.458	
Cadet Outcome Metric Score			
1	Academic	-.131	**100%**
2	Leadership	.017	39%
3	Physical	-.013	36%
Cadet Background & Experience Form			
4	Achievement	-.601	**100%**
5	Fit/Commitment	.347	**100%**
6	Response Distortion	-.092	83%
7	Peer Leadership	.398	**100%**
8	Fitness	.007	29%
9	Tolerance	.733	**100%**
Work Values Inventory			
10	Profile Similarity Index	-.247	**100%**
Leader Knowledge Test			
11	LKT – Characteristics	-.170	74%
12	LKT – Skills	.007	32%

Note. $\bar{b}$ = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top predictors for the criterion. Logistic multiple regression analyses were conducted using the Active Duty Sample filter.

For the new predictors, higher (+) scores on CBEF Fit/Commitment Composite, Peer Leadership Scale, and Tolerance Composite were associated with greater likelihoods of retention. Further, lower (-) scores on CBEF Achievement Composite, Academic OMS, and WVI – PSI were associated with greater likelihoods of retention.

Table B.6 presents BMA regression coefficients and predictor criticality values across the branch clusters. Overall, CBEF Achievement, CBEF Fit/Commitment, CBEF Tolerance, and LKT Characteristics tended to yield variable regression weights with higher criticality across branch clusters. As mentioned before, given the low base rates of attrition, these results would need replication using larger samples.

Table B.6. Retention Logistic Bayesian Model Averaging Results by Functional Category

Predictor		Retention					
		Functional Category: Maneuver, Fires, & Effects					
		Maneuver *n* = 2,972		Maneuver Support *n* = 1,846		Fires *n* = 1,309	
		$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept		4.366		3.503		4.125	
Outcome Metric Score							
1	Academic	-.370	**87%**	-.247	**75%**	-.520	**90%**
2	Leadership	-.120	**45%**	-.061	37%	-.365	**72%**
3	Physical	-.073	35%	-.026	30%	.134	45%
Cadet Background & Experience Form							
4	Achievement	-.005	30%	-.232	45%	-.026	31%
5	Fit/Commitment	.012	32%	.352	**59%**	.399	56%
6	Response Distortion	.102	40%	-.010	30%	.199	50%
7	Peer Leadership	.018	29%	.072	36%	.039	30%
8	Fitness	-.043	31%	-.033	31%	-.165	41%
9	Tolerance	.344	**67%**	.515	**77%**	-.195	41%
Work Values Inventory							
10	Profile Similarity Index	-.066	33%	-.157	45%	.050	30%
Leader Knowledge Test							
11	LKT – Characteristics	.050	30%	-.545	52%	-.848	**58%**
12	LKT – Skills	-.223	39%	.237	41%	-.194	34%

continued

Table B.6. (Continued)

Predictor		Retention							
		Functional Category: Operations Support				Functional Category: Force Sustainment			
		Intelligence, Surveillance, & Reconnaissance *n* = 1,941		Network & Space Ops *n* = 1,309		Health Services *n* = 792		IL/CSS *n* = 3,674	
		$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept		4.123		3.642		4.034		3.419	
Outcome Metric Score									
1	Academic	-.044	32%	-.022	28%	.013	27%	-.393	**100%**
2	Leadership	-.038	31%	-.021	28%	-.075	31%	-.021	31%
3	Physical	-.023	28%	-.013	27%	-.024	27%	.002	27%
Cadet Background & Experience Form									
4	Achievement	-.358	49%	-.063	31%	.231	**42%**	-.512	**71%**
5	Fit/Commitment	.374	**54%**	.122	37%	.051	31%	.202	53%
6	Response Distortion	-.140	44%	-.133	**45%**	-.069	32%	.047	36%
7	Peer Leadership	.119	38%	.017	29%	.052	32%	.264	66%
8	Fitness	.032	30%	.025	29%	.076	31%	.001	29%
9	Tolerance	.852	**84%**	.313	**52%**	.107	**33%**	.868	**99%**
Work Values Inventory									
10	WVI – Profile Similarity Index	-1.140	**99%**	-.407	**62%**	.128	**35%**	-.263	73%
Leader Knowledge Test									
11	LKT – Characteristics	-.639	52%	-.046	28%	-.130	29%	-.386	53%
12	LKT – Skills	.390	49%	.004	28%	-.223	32%	.150	39%

Note. ILC/SS = Integrated Logistics Corps / Soldier Support. $\bar{b}$ = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Logistic multiple regression analyses were conducted using the Active Duty Sample filter.

Table B.7 presents validity evidence for regression analyses that include all available predictors for the Active Duty Sample, by-rank, and by-branch cluster samples. For these logistic regression models, we calculated (a) McFadden's Pseudo-*R* values, and (b) Multiple *R* values with point-biserial correlations. BMA Pseudo-*R* values were based on the model-averaged regression coefficients, whereas full regression *R* values were point-biserial correlations based on single logistic regression models. We note the difference in magnitude between the full regression *R*'s and McFadden's Pseudo-*R*'s is due to the Pseudo-*R*'s being less affected by the low base rate of separation than point-biserial correlations.

Table B.7. Validity of Optimized Predictor Composites

	Retention			
	BMA Pseudo-*R*	Full Regression Pseudo-*R*	Full Regression Adj. Pseudo-*R*	Full Regression *R*
Active Duty Sample (*n* =15,151)	.168	.168	.164	.126
Rank				
Lieutenants (n = 10,329)	.182	.183	.177	.116
Captains (n = 4,696)	.169	.172	.157	.153
Functional Category and Branch Cluster				
Maneuver, Fires, & Effects				
Maneuver (*n* = 2,972)	.169	.180	.158	.074
Maneuver Support (*n* = 1,846)	.203	.228	.201	.119
Fires (*n* = 1,514)	.255	.274	.247	.122
Operations Support				
ISR (*n* = 1,941)	.230	.254	.231	.118
Network and Space Operations (*n* = 1,309)	.126	.170	.117	.084
Force Sustainment				
Health Services (*n* = 792)	.172	.207	.136	.094
ILC/SS (*n* = 3,674)	.212	.220	.206	.118

Note. ISR = Intelligence, Surveillance, & Reconnaissance. ILC/SS = Integrated Logistics Corps/Soldier Support. Full Regression Pseudo-*R* is McFadden's Pseudo-*R* with the separation criterion. Adj. Pseudo-*R* is estimated population cross-validity for the regression models including all predictors.

Overall, BMA Pseudo-*R* values were similar in magnitude to their single regression counterparts. This finding suggests that the more stable BMA regression coefficients predict at a similar strength as the optimally weighted single regression models. BMA Pseudo-*R* values ranged from .126 to .255. Across branch clusters, predictor battery validities resembled those for the overall sample and by rank groups. Across branches, retention tended to be somewhat more predictable for the Maneuver: Fires and ISR clusters.

Summary

Overall, a mix of pre-commissioning and non-cognitive predictors provided a modest level of prediction of retention. Hierarchical regression analyses indicated that the addition of the new predictors predicted retention beyond Cadet OMS components, suggesting additional utility in predicting retention. BMA analyses indicated that the Academic OMS, the CBEF composites of Achievement, Fit/Commitment, and Tolerance, the CBEF Peer Leadership Scale, and the WVI – PSI all predicted retention.

Chapter 4 suggests that performance and retention can be simultaneously optimized in a branching algorithm. Future research needs to further examine the usefulness of the new predictors with operational constraints. Which scales can be eliminated to reduce testing time? How can we best optimize prediction of both performance and retention when branching officers?

APPENDIX C
VALIDATION RESULTS SUPPLEMENT

Table C.1. Bivariate Validities: Performance Criteria by Rank

Rank	Predictor													
	Cadet Outcome Metric Score (OMS)			Cadet Background & Experience Form (CBEF)						WVI	Leader Knowledge Test (LKT)		Other	
	ACS	LCS	PCS	AC	FC	RD	PL	FC	ST	PSI	CH	SK	FIT	CQI
Lieutenants														
PC: Weighted 8-Factor	**.15**	**.24**	**.15**	**.17**	**.10**	.04	**.16**	**.11**	**.06**	**.05**	-.01	-.02	.00	**-.06**
PC: Can-do	**.11**	**.27**	**.16**	**.12**	**.11**	**-.05**	**.13**	**.22**	.03	**.10**	-.03	.00	.03	-.03
PC: Will-do	**.08**	**.15**	**.07**	**.17**	**.14**	.00	**.16**	**.16**	**.06**	**.08**	-.01	.00	-.03	-.04
Captains														
PC: Weighted 8-Factor	**.15**	**.26**	**.13**	**.18**	**.18**	.00	**.16**	**.17**	**.11**	**.09**	**.08**	.06	.05	-.04
PC: Can-do	-.03	**.30**	**.30**	**.14**	**.20**	-.06	**.14**	**.34**	.06	**.14**	-.05	-.04	-.02	.06
PC: Will-do	-.01	**.24**	**.20**	**.20**	**.22**	-.03	**.23**	**.29**	**.08**	**.09**	-.03	-.03	.01	.02

Note. Sample *n*'s: Lieutenants = 1,484–1,649, Captains = 721–856. PC = performance composite. ACS = Academic Component Score. LCS = Leadership Component Score. PCS = Physical Component Score. AC = Achievement. FC = Fit/Commitment. RD = Response Distortion. PL = Peer Leadership. F = Fitness. T = Tolerance. WVI PSI = Work Values Inventory – Profile Similarity Index. CH = Characteristics. SK = Skills. FIT = Predicted Interest-Branch Fit. CQI = College Quality Index. OMS = Outcome Metric Score. Bolded values indicate statistical significance ($p < .05$).

Table C.2. Bivariate Validities: Branch Satisfaction by Rank and Branch Cluster

Branch Satisfaction	Predictor													
	Cadet Outcome Metric Score (OMS)			Cadet Background & Experience Form (CBEF)						WVI	Leader Knowledge Test (LKT)		Other	
	ACS	LCS	PCS	AC	FC	RD	PL	FC	ST	PSI	CH	SK	FIT	CQI
Rank														
Lieutenants	**.10**	.05	-.04	**.08**	**.09**	.02	**.05**	.05	**.09**	**.06**	**.09**	**.07**	.00	-.01
Captains	.04	**.10**	.01	**.07**	**.08**	.07	.06	.01	**.09**	.02	-.02	.00	-.01	-.02
Functional Category/Branch Cluster														
Maneuver, Fires, & Effects														
Maneuver	.07	.08	.00	**.12**	.09	-.02	**.10**	**.10**	.08	.07	-.02	-.06	-.09	.02
Infantry Branch	.04	.12	.05	.12	.11	-.07	.09	.12	.10	.11	.00	.01	-.06	.04
Maneuver Support	.08	**.12**	-.08	.00	.00	.06	.05	-.04	.02	.02	.04	.04	.05	-.02
Fires	-.03	-.08	.03	.11	**.13**	.02	.06	-.07	.10	-.01	.04	**.16**	.01	-.04
Operations Support														
Intelligence, Surveillance, & Reconnaissance (ISR)	-.04	.00	-.06	.11	**.16**	.03	.02	.05	**.16**	.05	.11	.09	.05	-.10
Network and Space Operations	.10	.14	.02	.11	.05	.05	.11	.06	.09	.08	.09	.08	.00	.02
Force Sustainment														
Health Services	.11	-.12	**-.30**	-.03	.02	-.03	-.08	-.02	.05	-.05	.00	.08	-.03	.02
Integrated Logistics Corps / Soldier Support	.02	-.04	**-.10**	.03	.07	**.11**	-.02	-.05	**.12**	.01	**.10**	.02	.04	-.03

Note. Sample *n*'s: Lieutenants = 8,124–11,308, Captains = 1,036–6,050, Maneuver = 1,917 – 3,335, Infantry Branch = 1,020–1,751, Maneuver Support = 1,377–2,131, Fires = 1,005–1,669, ISR = 1,227–2,132, Network and Space Operations = 873–1,451, Health Services = 485–895, Integrated Logistics Corps / Soldier Support = 2,276–4,030. ACS = Academic Component Score. LCS = Leadership Component Score. PCS = Physical Component Score. AC = Achievement. FC = Fit/Commitment. RD = Response Distortion. PL = Peer Leadership. F = Fitness. T = Tolerance. WVI PSI = Work Values Inventory – Profile Similarity Index. CH = Characteristics. SK = Skills. FIT = Predicted Interest-Branch Fit. CQI = College Quality Index. Bolded values indicate statistical significance ($p < .05$).

Table C.3. Incremental Validity of New Predictors Overall and by Rank

Criterion		Cadet Outcome Metric Score (OMS) Only			Cadet OMS + New Predictors				
	n	*df*	*R*	Adj. *R*	*df*	*R*	Adj. *R*	Δ*R*	Δ Adj. *R*
Overall Sample									
Branch Satisfaction	1,772	4	.102	.080	14	.154	.103	.051**	.023
Rank									
Lieutenants									
Wtd. 8-Factor Composite	1,368	4	.282	.272	14	.325	.296	.043**	.024
Can-do Composite	1,368	4	.296	.287	14	.348	.322	.052**	.035
Will-do Composite	1,368	4	.182	.167	14	.262	.225	.080**	.059
Branch Satisfaction	1,206	4	.114	.086	14	.172	.106	.058**	.021
Captains									
Wtd. 8-Factor Composite	572	4	.283	.260	14	.373	.315	.090**	.055
Can-do Composite	572	4	.389	.374	14	.463	.420	.073**	.046
Will-do Composite	572	4	.259	.234	14	.385	.329	.126**	.095
Branch Satisfaction	566	4	.125	.070	14	.188	.058	.062	-.012

Note. Adjusted *R* reflects a Burket adjustment for shrinkage. * $p < .05$. ** $p < .01$. Cadet OMS Only includes the three Cadet OMS components (Academic, Leadership, and Physical) and the covariate College Quality Index. New Predictors are six CBEF composites, 2 LKT scores, Predicted Interest-Branch Fit and the WVI – Profile Similarity Index.

Table C.4. Full Validation Model Regression Coefficients for Validation Sample

	Criterion					
	Can-do *n* = 1,940		Will-do *n* = 1,940		Branch Satisfaction *n* = 1,772	
Predictor	*b*	β	*b*	β	*b*	β
Intercept	-.162		-.106		1.543	
Cadet Outcome Metric Score						
Academic	-.006	-.007	.002	.002	**.036**	**.055**
Leadership	**.196**	**.231**	**.129**	**.149**	**.047**	**.071**
Physical	**.059**	**.067**	.014	.016	-.022	-.032
Cadet Background & Experience Form						
Achievement	-.088	-.108	.028	-.033	**-.136**	**-.215**
Fit/Commitment	.058	.068	**.161**	**.186**	**.110**	**.166**
Response Distortion	-.023	-.032	-.011	-.015	-.007	-.012
Peer Leadership	.067	.091	**.077**	**.101**	**.084**	**.147**
Fitness	**.178**	**.197**	.063	.069	**-.071**	**-.100**
Tolerance	-.076	-.087	**-.135**	**-.152**	.076	.111
Work Values Inventory						
Profile Similarity	-.025	-.024	-.031	-.029	.007	.008
Leader Knowledge Test						
Characteristics	-.056	-.025	-.031	-.013	.007	.004
Skills	.014	.006	.023	.010	-.040	-.025
Other						
Predicted Interest-Branch Fit	.065	.036	-.003	-.001	-.004	-.003
College Quality Index	**-.053**	**-.065**	**-.051**	**-.061**	.007	.012

Note. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.5. Full Validation Model Regression Coefficients for Lieutenants

Predictor	Criterion							
	Wtd. 8-Factor *n* = 1,368		Can-do *n* = 1,368		Will-do *n* = 1,368		Branch Satisfaction *n* = 1,206	
	b	β	*b*	β	*b*	β	*b*	β
Intercept	-.266		-.295		-.266		1.527	
Cadet Outcome Metric Score								
Academic	.028	.024	.022	.027	.016	.019	**.062**	**.092**
Leadership	**.090**	**.075**	**.168**	**.209**	**.109**	**.129**	.024	.035
Physical	**.067**	**.054**	**.054**	**.064**	.017	.019	-.020	-.029
Cadet Background & Experience Form								
Achievement	**.113**	**.099**	.005	.006	.088	.115	-.086	-.140
Fit/Commitment	.020	.018	.006	.008	.098	.124	.059	.095
Response Distortion	-.014	-.014	-.003	-.004	.006	.008	-.064	-.117
Peer Leadership	-.007	-.007	.043	.064	.032	.046	**.075**	**.135**
Fitness	-.029	-.023	**.167**	**.207**	.042	.050	-.063	-.093
Tolerance	-.048	-.039	-.112	-.144	-.161	-.197	.073	.110
Work Values Inventory								
Profile Similarity	-.005	-.003	-.034	-.033	-.015	-.014	.022	.026
Leader Knowledge Test								
Characteristics	.055	.017	.267	.059	.296	.062	1.199	.317
Skills	-.208	-.069	-.060	-.014	-.129	-.029	-1.172	-.333
Other								
Predicted Interest-Branch Fit	.001	.006	.052	.032	-.049	-.029	.002	.001
College Quality Index	**-.044**	**-.039**	**-.056**	**-.075**	**-.049**	**-.064**	.011	.018

Note. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.6. Full Validation Model Regression Coefficients for Captains

Predictor	Criterion							
	Wtd. 8-Factor n = 572		Can-do n = 572		Will-do n = 572		Branch Satisfaction n = 566	
	b	β	*b*	β	*b*	β	*b*	β
Intercept	.189		.136		.255		1.579	
Cadet Outcome Metric Score								
Academic	**.067**	**.058**	-.045	-.058	-.011	-.015	-.012	-.019
Leadership	**.078**	**.066**	**.221**	**.276**	**.116**	**.168**	**.092**	**.144**
Physical	.015	.012	**.095**	**.117**	.053	.075	-.021	-.033
Cadet Background & Experience Form								
Achievement	**-.183**	**-.160**	**-.306**	**-.353**	**-.291**	**-.389**	-.195	-.280
Fit/Commitment	**.206**	**.173**	.155	.163	**.225**	**.273**	.145	.189
Response Distortion	.032	.031	.011	.014	-.005	-.007	.049	.077
Peer Leadership	**.107**	**.104**	.129	.172	**.199**	**.306**	.119	.198
Fitness	.030	.024	**.273**	**.274**	**.156**	**.182**	-.080	-.101
Tolerance	-.035	-.028	.013	.013	.022	.026	.062	.079
Work Values Inventory								
Profile Similarity	-.046	-.031	-.063	-.068	**-.112**	**-.139**	-.011	-.014
Leader Knowledge Test								
Characteristics	.036	.011	-.080	-.062	-.040	-.036	-.014	-.013
Skills	.006	.002	.021	.017	.016	.015	-.012	-.012
Other								
Predicted Interest-Branch Fit	.052	.021	.046	.025	.066	.041	-.022	-.014
College Quality Index	-.009	-.007	.013	.016	.009	.012	.000	.001

Note. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.7. Full Validation Model Regression Coefficients for Maneuver, Fires, and Effects: Maneuver Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 412		Branch Satisfaction *n* = 350	
	b	β	*b*	β
Intercept	-.050		**1.725**	
Cadet Outcome Metric Score				
Academic	-.008	-.014	.037	.051
Leadership	**.089**	**.154**	.039	.049
Physical	.022	.031	-.097	-.101
Cadet Background & Experience Form				
Achievement	-.009	-.015	-.093	-.124
Fit/Commitment	.077	.143	-.080	-.111
Response Distortion	-.051	-.084	-.029	-.033
Peer Leadership	.005	.010	.109	.162
Fitness	-.100	-.170	.097	.120
Tolerance	-.044	-.077	.138	.178
Work Values Inventory				
Profile Similarity	.033	.049	-.002	-.002
Leader Knowledge Test				
Characteristics	-.082	-.082	.085	.067
Skills	.074	.083	-.161	-.142
Other				
Predicted Interest-Branch Fit	.017	.013	-.155	-.092
College Quality Index	-.041	-.081	.021	.030

Note. The first two criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.8. Full Validation Model Regression Coefficients for Maneuver, Fires, and Effects: Maneuver Support Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 295		Branch Satisfaction *n* = 277	
	b	β	*b*	β
Intercept	**-.188**		**1.495**	
Cadet Outcome Metric Score				
Academic	**.077**	**.129**	.035	.056
Leadership	.078	.126	**.120**	**.186**
Physical	.053	.089	**-.113**	**-.183**
Cadet Background & Experience Form				
Achievement	.026	.050	**-.422**	**-.775**
Fit/Commitment	.037	.069	.176	.309
Response Distortion	.034	.065	.086	.156
Peer Leadership	.025	.051	**.205**	**.410**
Fitness	.033	.054	-.057	-.088
Tolerance	-.051	-.088	.050	.081
Work Values Inventory				
Profile Similarity	-.028	-.036	.013	.017
Leader Knowledge Test				
Characteristics	-.003	-.002	.028	.021
Skills	-.090	-.062	.091	.063
Other				
Predicted Interest-Branch Fit	-.008	-.006	.016	.012
College Quality Index	.039	.067	.005	.008

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.9. Full Validation Model Regression Coefficients for Maneuver, Fires, and Effects: Fires Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 226		Branch Satisfaction *n* = 212	
	b	β	*b*	β
Intercept	**-.139**		1.492	
Cadet Outcome Metric Score				
Academic	.015	.028	-.045	-.071
Leadership	.026	.044	-.020	-.029
Physical	.039	.074	.077	.128
Cadet Background & Experience Form				
Achievement	.027	.052	.017	.028
Fit/Commitment	**.259**	**.436**	**.380**	**.540**
Response Distortion	.076	.153	.063	.107
Peer Leadership	.018	.037	.013	.023
Fitness	-.062	-.101	**-.322**	**-.437**
Tolerance	**-.297**	**-.486**	-.125	-.170
Work Values Inventory				
Profile Similarity	.048	.070	-.028	-.035
Leader Knowledge Test				
Characteristics	-.101	-.070	-.146	-.087
Skills	**.484**	**.236**	**.502**	**.210**
Other				
Predicted Interest-Branch Fit	-.021	-.015	-.076	-.044
College Quality Index	.012	.021	.009	.014

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.10. Full Validation Model Regression Coefficients for Operations Support: Intelligence, Surveillance, & Reconnaissance Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 249		Branch Satisfaction *n* = 209	
	b	β	*b*	β
Intercept	-.141		**1.636**	
Cadet Outcome Metric Score				
Academic	.031	.050	-.013	-.020
Leadership	**.212**	**.356**	.023	.038
Physical	.009	.014	-.018	-.027
Cadet Background & Experience Form				
Achievement	-.013	-.020	-.119	-.187
Fit/Commitment	.153	.234	.198	.308
Response Distortion	.073	.135	-.025	-.040
Peer Leadership	.041	.071	.031	.055
Fitness	.054	.080	-.076	-.115
Tolerance	**-.312**	**-.491**	.035	.053
Work Values Inventory				
Profile Similarity	.055	.066	-.006	-.007
Leader Knowledge Test				
Characteristics	**.382**	**.167**	.014	.006
Skills	.149	.085	.052	.032
Other				
Predicted Interest-Branch Fit	-.057	-.026	.024	.011
College Quality Index	**-.122**	**-.213**	-.037	-.063

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.11. Full Validation Model Regression Coefficients for Operations Support: Network and Space Operations Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 158		Branch Satisfaction *n* = 144	
	b	β	*b*	β
Intercept	**-.145**		**1.524**	
Cadet Outcome Metric Score				
Academic	.037	.063	.019	.024
Leadership	**.096**	**.171**	.076	.100
Physical	-.038	-.072	.037	.053
Cadet Background & Experience Form				
Achievement	.084	.163	.009	.014
Fit/Commitment	.127	.233	-.100	-.139
Response Distortion	.028	.074	.018	.037
Peer Leadership	.060	.130	.087	.143
Fitness	.049	.083	-.091	-.116
Tolerance	-.194	-.369	.073	.106
Work Values Inventory				
Profile Similarity	.015	.022	.062	.072
Leader Knowledge Test				
Characteristics	**.575**	**.287**	.211	.081
Skills	**-.434**	**-.287**	-.039	-.020
Other				
Predicted Interest-Branch Fit	.005	.006	.088	.077
College Quality Index	-.053	-.104	.028	.041

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.12. Full Validation Model Regression Coefficients for Force Sustainment: Health Services Branch Cluster

Predictor	Criterion			
	Performance Composite *n* = 127		Branch Satisfaction *n* = 121	
	b	*β*	*b*	*β*
Intercept	.212		**1.812**	
Cadet Outcome Metric Score				
Academic	.077	.114	**.125**	**.240**
Leadership	**.140**	**.230**	-.025	-.055
Physical	.017	.022	**-.155**	**-.257**
Cadet Background & Experience Form				
Achievement	.040	.059	**-.484**	**-.914**
Fit/Commitment	-.018	-.028	.155	.294
Response Distortion	-.018	-.033	-.124	-.292
Peer Leadership	.049	.082	**.223**	**.489**
Fitness	.007	.010	-.013	-.022
Tolerance	-.026	-.038	**.421**	**.777**
Work Values Inventory				
Profile Similarity	-.023	-.027	-.113	-.161
Leader Knowledge Test				
Characteristics	-.248	-.122	-.180	-.116
Skills	.706	.266	-.009	-.004
Other				
Predicted Interest-Branch Fit	-.408	-.165	-.170	-.090
College Quality Index	**-.143**	**-.233**	**.097**	**.207**

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.13. Full Validation Model Regression Coefficients for Force Sustainment: Integrated Logistics Corps / Soldier Support Branch Cluster

Predictor	Criterion			
	Performance Composite $n = 473$		Branch Satisfaction $n = 449$	
	b	*β*	*b*	*β*
Intercept	**-.178**		**1.422**	
Cadet Outcome Metric Score				
Academic	.045	.080	.002	.003
Leadership	**.090**	**.151**	-.015	-.021
Physical	**.062**	**.114**	-.037	-.059
Cadet Background & Experience Form				
Achievement	.106	.213	-.071	-.123
Fit/Commitment	.108	.199	.140	.223
Response Distortion	.070	.174	.032	.070
Peer Leadership	-.012	-.026	-.002	-.004
Fitness	-.012	-.020	-.093	-.137
Tolerance	**-.256**	**-.471**	.013	.021
Work Values Inventory				
Profile Similarity	.027	.042	-.004	-.005
Leader Knowledge Test				
Characteristics	**.806**	**.295**	.272	.088
Skills	**-.392**	**-.163**	-.162	-.059
Other				
Predicted Interest-Branch Fit	**.098**	**.095**	.066	.056
College Quality Index	-.038	-.071	.012	.020

Note. The criteria are based on the Validation Sample. *b* = unstandardized regression coefficient. β = standardized regression coefficient. Bolded values indicate statistical significance at $p < .05$.

Table C.14. Validation OLS Bayesian Model Averaging Results: Lieutenants

	Criterion							
	Wtd. 8-Factor *n* = 1,368		Can-do *n* = 1,368		Will-do *n* = 1,368		Branch Satisfaction *n* = 1,206	
Predictor	*b*	*PC*	*b*	*PC*	*b*	*PC*	*b*	*PC*
Intercept	-.262		-.279		-.281		1.537	
Cadet Outcome Metric Score								
Academic	.019	69%	.009	38%	.005	31%	.059	**97%**
Leadership	.091	**100%**	.177	**100%**	.116	**100%**	.008	37%
Physical	.063	**100%**	.043	80%	.006	32%	-.009	39%
Cadet Background & Experience Form								
Achievement	.104	**99%**	.012	42%	.099	**78%**	-.017	40%
Fit/Commitment	.003	31%	-.004	30%	.069	66%	.028	48%
Response Distortion	-.004	41%	-.012	45%	-.021	47%	-.017	42%
Peer Leadership	-.002	30%	.025	60%	.021	46%	.027	58%
Fitness	-.010	40%	.155	**100%**	.021	44%	-.026	50%
Tolerance	-.045	70%	-.077	73%	-.082	70%	.015	42%
Work Values Inventory								
Profile Similarity	-.004	30%	-.015	38%	-.005	30%	.015	40%
Leader Knowledge Test								
Characteristics	-.044	41%	-.006	38%	-.062	36%	.736	**70%**
Skills	-.057	40%	.050	37%	-.032	37%	-.563	**64%**
Other								
Predicted Interest-Branch Fit	.000	27%	.024	45%	-.018	38%	.001	27%
College Quality Index	-.045	**99%**	-.056	**97%**	-.041	**85%**	.003	29%

Note. $\bar{b}$ = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models.
PC = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table C.15. Validation OLS Bayesian Model Averaging Results: Captains

Predictor	Criterion							
	Wtd. 8-Factor n = 572		Can-do n = 572		Will-do n = 572		Branch Satisfaction n = 566	
	b	*PC*	*b*	*PC*	*b*	PC	*b*	PC
Intercept	.201		.157		.277		1.575	
Cadet Outcome Metric Score								
Academic	.061	**98%**	-.037	62%	-.005	29%	-.006	31%
Leadership	.083	**100%**	.210	**100%**	.117	**100%**	.073	**93%**
Physical	.006	36%	.091	**94%**	.032	59%	-.011	37%
Cadet Background & Experience Form								
Achievement	-.128	79%	-.141	75%	-.230	85%	-.019	35%
Fit/Commitment	.174	**98%**	.037	41%	.178	81%	.026	39%
Response Distortion	.010	41%	.001	28%	-.001	27%	.037	**66%**
Peer Leadership	.082	84%	.048	53%	.165	**94%**	.021	**41%**
Fitness	.011	35%	.293	**100%**	.176	**97%**	-.025	42%
Tolerance	-.019	41%	-.012	35%	.000	30%	.022	40%
Work Values Inventory								
Profile Similarity	-.030	66%	-.022	42%	-.096	92%	.001	28%
Leader Knowledge Test								
Characteristics	.012	38%	-.044	53%	-.012	32%	-.007	29%
Skills	.005	30%	-.003	30%	.001	27%	-.008	31%
Other								
Predicted Interest-Branch Fit	.022	44%	.018	33%	.027	39%	-.004	27%
College Quality Index	-.002	28%	.004	28%	.003	28%	-.001	27%

Note. $\bar{b}$ = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models.
PC = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table C.16. Bayesian Model Averaging Results for Predicting Branch Satisfaction

Functional Category:	Maneuver, Fires, & Effects						Operations Support				Force Sustainment			
Predictor	Maneuver n = 360		Maneuver Support n = 277		Fires n = 212		ISR n = 209		Network Space Operations n = 144		Health Services n = 121		ILC/SS n = 449	
	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*	$\bar{b}$	*PC*
Intercept	1.734		1.512		1.477		1.629		1.578		1.766		1.442	
Cadet Outcome Metric Score														
Academic	.014	36%	.012	34%	-.020	40%	-.001	26%	.012	29%	.040	50%	-.001	27%
Leadership	.019	38%	.103	**89%**	-.009	30%	.002	26%	.043	**47%**	.000	26%	-.007	31%
Physical	-.027	41%	-.097	**89%**	.042	58%	-.009	30%	.008	27%	-.113	**84%**	-.020	**48%**
Cadet Background & Experience Form														
Achievement	.009	37%	-.282	**90%**	.005	27%	-.015	33%	.029	**36%**	-.138	**60%**	-.020	41%
Fit/Commitment	-.007	30%	.067	51%	.324	**99%**	.073	**57%**	-.037	35%	.017	32%	.079	**63%**
Response Distortion	-.004	28%	.050	63%	.008	30%	-.006	28%	.010	31%	-.038	49%	.016	45%
Peer Leadership	.045	**59%**	.142	84%	.009	29%	-.007	30%	.024	**38%**	.054	47%	-.014	41%
Fitness	.018	34%	-.018	35%	-.297	**100%**	-.016	33%	-.029	35%	-.006	28%	-.075	**71%**
Tolerance	.023	37%	.068	53%	-.030	35%	.023	**37%**	.024	33%	.189	**82%**	.032	46%
Work Values Inventory														
Profile Similarity Index	.013	32%	.009	29%	-.012	30%	.003	28%	.012	28%	-.014	30%	-.002	28%
Leader Knowledge Test														
Characteristics	.007	32%	.015	30%	-.048	37%	.028	30%	.055	30%	-.041	31%	.096	42%
Skills	-.059	**53%**	.037	38%	.227	**67%**	.025	30%	.026	28%	.023	29%	-.047	35%
Other														
Predicted Interest-Branch Fit	-.114	**68%**	.006	26%	-.028	31%	.009	26%	.027	32%	-.025	27%	.028	42%
College Quality Index	.004	27%	-.001	26%	.003	26%	-.014	**35%**	.006	26%	.038	53%	.001	27%

Note. ISR = Intelligence, Surveillance, and Reconnaissance. ILC/SS = Integrated Logistics Corp / Soldier Support. b = average AIC (Akaike Information Criterion) probability weighted beta estimate across all possible models. *PC* = AIC predictor criticality, the cumulative probability among all models containing the predictor of interest. Bolded values represent the top three predictors for each criterion. Linear multiple regression analyses were conducted using the Validation Sample filter.

Table C.17. Validity of Optimized Predictor Composites: Overall, by Rank and Branch Cluster

Sample/Criterion	BMA *R*	Full Regression *R*	Full Regression Adj. *R*
Overall Sample			
Can-do (*n* = 1,940)	.363	.364	.347
Will-do (*n* = 1,940)	.270	.272	.247
Branch Satisfaction (*n* = 1,772)	.149	.154	.103
Lieutenants			
Weighted 8-Factor (*n* = 1,368)	.323	.325	.296
Can-do (*n* = 1,368)	.346	.348	.322
Will-do (*n* = 1,368)	.260	.262	.225
Branch Satisfaction (*n* = 1,206)	.162	.172	.106
Captains			
Weighted 8-Factor (*n* = 572)	.367	.373	.315
Can-do (*n* = 572)	.458	.463	.420
Will-do (*n* = 572)	.382	.385	.329
Branch Satisfaction (*n* = 566)	.170	.188	.058
Maneuver, Fires, & Effects Branch Cluster			
Maneuver (*n* =360)	.204	.226	.055
Maneuver Support (*n* =277)	.294	.302	.141
Fires (*n* =212)	.357	.377	.216
Operations Support Branch Cluster			
Intel, Surveil, & Recon (*n* =209)	.179	.197	-.152
Network & Space Ops (*n* =144)	.230	.244	-.172
Force Sustainment Branch Cluster			
Health Services (*n* =121)	.389	.443	.206
Integrated Log / Soldier Support (*n*=449)	.201	.209	.062

Note. Full Regression *R* is the multiple correlation of the OLS regression model including all predictors for continuous criteria. Adj. *R* represents the estimated population cross-validity for the regression models including all predictors.

APPENDIX D
BRANCHING PROCESS SIMULATION SUPPLEMENT

Method Details

Simulating the Cadet Population

Figures D.1 through D.4 graphically demonstrate the quality of the estimated joint distribution of selected scores for all years combined. Figure D.1 shows that the marginal distribution of actual and simulated scores are practically identical regardless of shape. Figures D.2 to D.4 show contour plots of pairwise densities of actual and simulated OML component scores. Overall, the pattern of contour lines for the simulated joint density closely resembles the pattern for actual joint density for each pair.

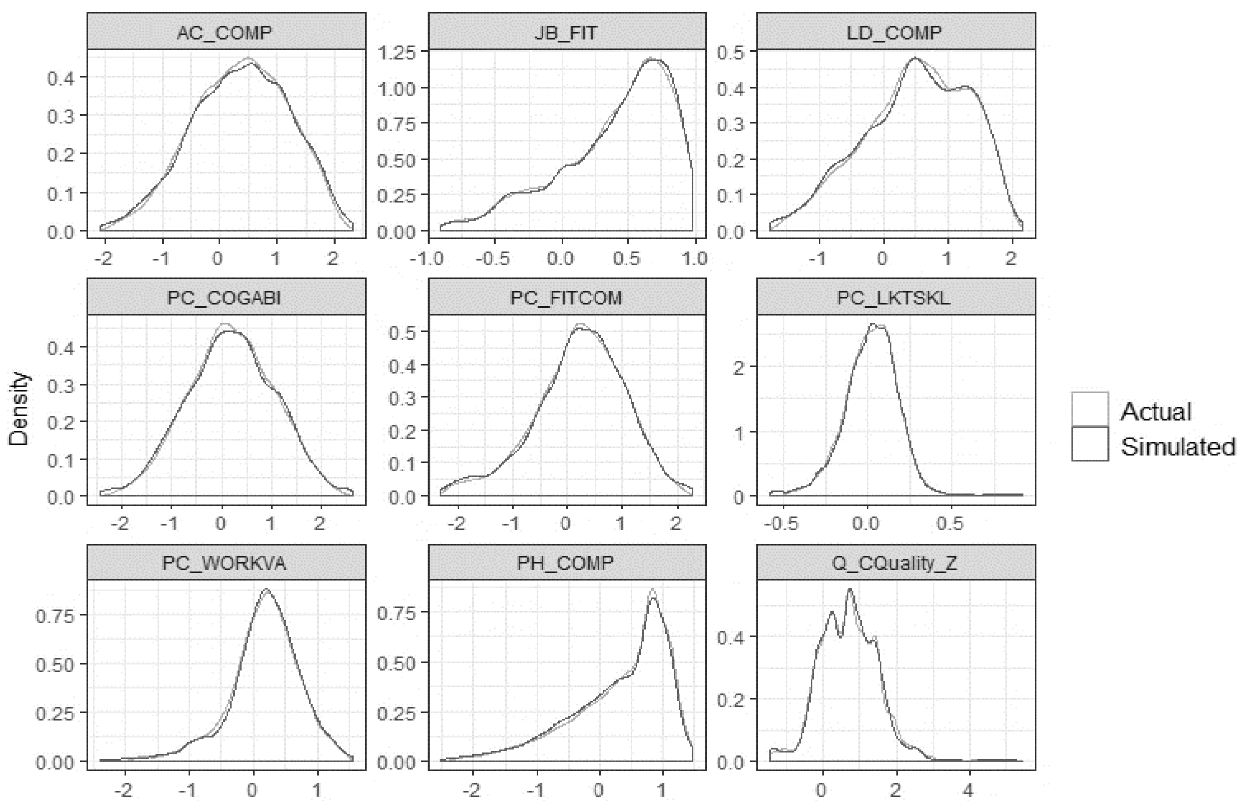


Figure D.1. Marginal distribution of selected actual and simulated variables.

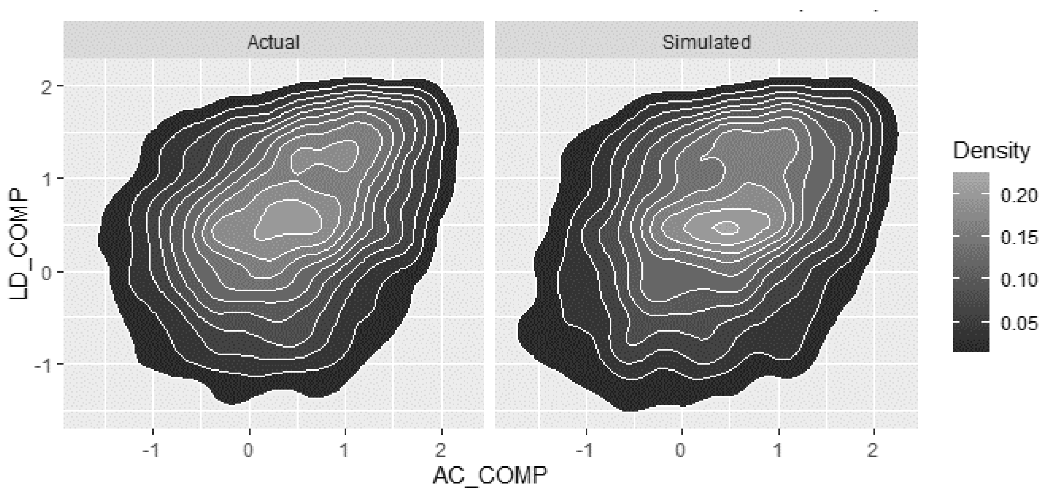


Figure D.2. Joint distribution of actual and simulated academic and leadership composites.

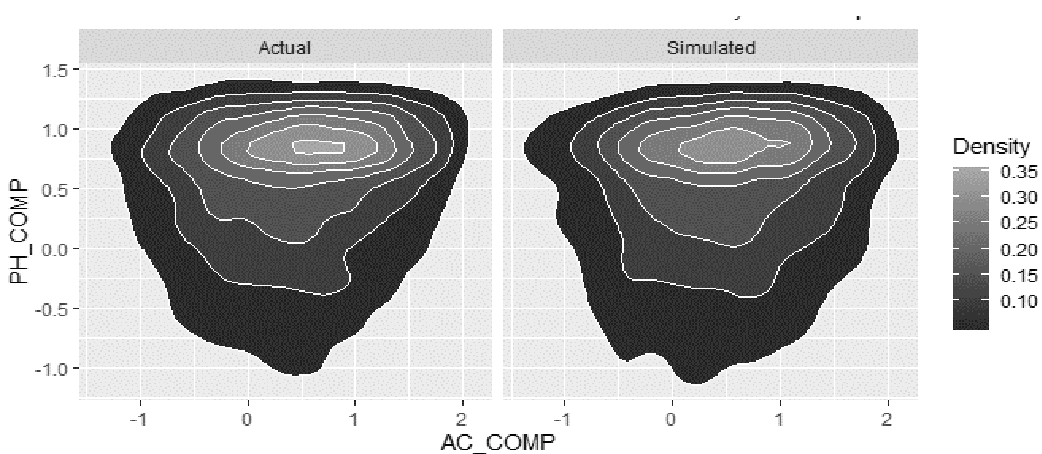


Figure D.3. Joint distribution of actual and simulated academic and physical composites.

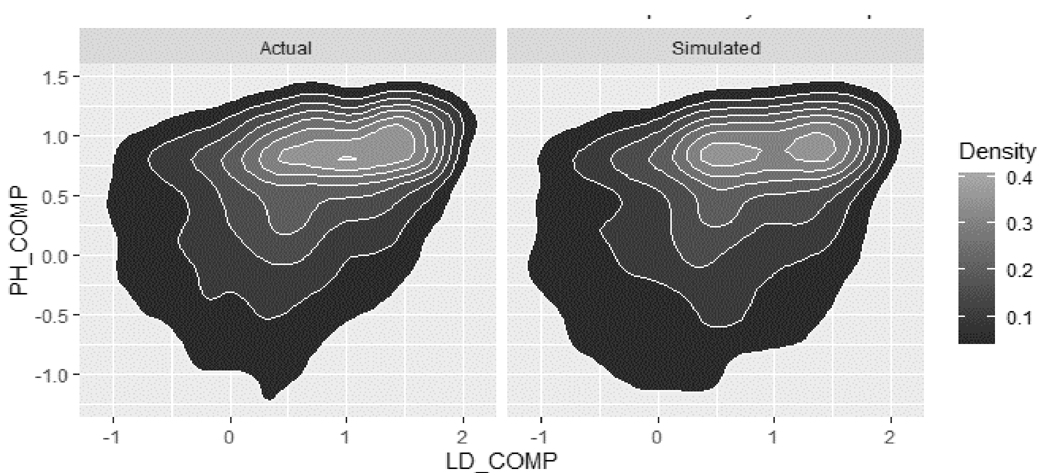


Figure D.4. Joint distribution of actual and simulated leadership and physical composites.

Modeling Cadet Preferences

All 17 branches in Figure D.5 were considered in the branching policy simulation analysis. Because some of the data were collected at a time when females were not allowed in combat branches, we estimated a branch preference model separately for males and females. The model used cadet preference information that was provided in the form of a list of branches rank ordered by preference for each cadet. Almost all cadets rank-ordered their branch preferences from 10 to a maximum of 15 of the branches; only these cadets were considered in the modeling. Branches not included in cadets' preference list were randomly ordered and appended to the bottom of the list. This randomization did not have any substantive effect on the results because very few cadets were assigned a branch outside of his/her top 10 preferences. We used the full set of 20 variables consisting of OML composite scores and other cadet characteristics as predictors of branch preference. In reality, cadet branch preference rankings are likely determined by many other factors beyond this set of variables. Altogether we had a total sample size of 7,249 cadets with 6,136 males and 1,113 females.

We considered two approaches for modeling cadet branch preferences. Initially we used an approach based on a multinomial logit model applied to ranked data in order to model cadet preferences. The multinomial logit models an individual's choice among a fixed set of alternatives as a function of characteristics of individuals and alternatives. The multinomial logit-based method applied to ranked data, often called exploded logit, creates multiple pseudo-observations from ranked data. For our specific problem, the first pseudo-observation identifies the top ranked branch as the "chosen" branch among all 17 branches. Next, the second pseudo-observation discards the top ranked branch and identifies the second ranked branch as the chosen branch among remaining 16 branches. And so on until the last pseudo-observation with only the bottom two branches remaining. This modeling approach had difficulty reproducing preference patterns involving a few branches near the top of the rank ordered list from where cadet branch assignments are chosen.

We subsequently employed a neural network multivariate regression to model cadet branch preference. This method is a more direct modeling approach treating rankings of 17 branches as a multidimensional or vector value response variable. Neural network regression also provides more flexibility in how predictors relate to branch preference. For instance, the effect of rectified linear unit (ReLU) activation functions used in our approach is similar to that of piecewise regression and can thus provide flexibility in modeling preferences near the top of the rank ordered list. In contrast to a traditional neural network that only models expected responses, we also included an error or stochastic component with variance that depends on predictors (i.e., heteroscedastic error). With the additional error component, the model can vary the predicted rank ordering of branches for the same or fixed values of the predictor variables to account for model uncertainty.

The following gives an overview of the mathematical representation of the model. For a given cadet with characteristics X and for branch $j = 1, \ldots, 17$ we specified a preference score model

$$\mathrm{U_j(X) = V_j(X) + \varepsilon_j(X)}$$

The left-hand-side (LHS) is the logit transformation

$$\mathrm{U_j(X)} = \log\left(\frac{\mathrm{R_j^*}}{1 - \mathrm{R_j^*}}\right)$$

where $\mathrm{R_j^*} = \mathrm{R_j}/(\mathrm{N_b} + 1)$ is the percentile rank of branch j among a total of N_b branches. The logit function simply transforms integer valued ranks to real numbers centered at zero with range around -3 to 3. The term $\mathrm{V_j(X)}$ is the expected/mean preference score and $\varepsilon_j(X)$ is a random/stochastic term representing unobserved preference or model uncertainty. The stochastic error terms were assumed to be normally distributed and independent across branches.

The above model was represented as a neural network with an input layer corresponding to predictor vector X, hidden layer using ReLU activation functions and hidden layer with output nodes representing estimated mean preferences, $\widehat{V_j}(X)$, and scale or standard deviation of error term, $\widehat{\sigma_E}^2(X)$. The ReLU activation function is a piecewise linear function that outputs the linear combination of predictors if positive and outputs zero otherwise. The neural network was estimated using the TensorFlow Probability Library (Dillon et al., 2017). We used standard multivariate linear regression as a preliminary step to identify a subset set of variables to include in the model to control the number of parameters in the neural network and help control overfitting. A separate hold-out sample was also used to monitor overfitting while parameter estimation was carried out on a separate sample.

The overall fit of the estimated model was reasonable. Figures D.5 and D.6 graphically compare actual and simulated preference percentage distributions for each branch. The horizontal axis represents preferences 1 to 17 and the vertical axis represents percentage the branch appeared in for each preference. Overall, the model was able to track actual preference distributions including branches with unusual patterns at or near the top rank, as shown in

Figure D.6 for Armor (AR), Aviation (AV), and Field Artillery (FA). Descriptive statistics for the Simulated and Actual Cadet Score Distribution are provided in Tables D-1 through D-3.

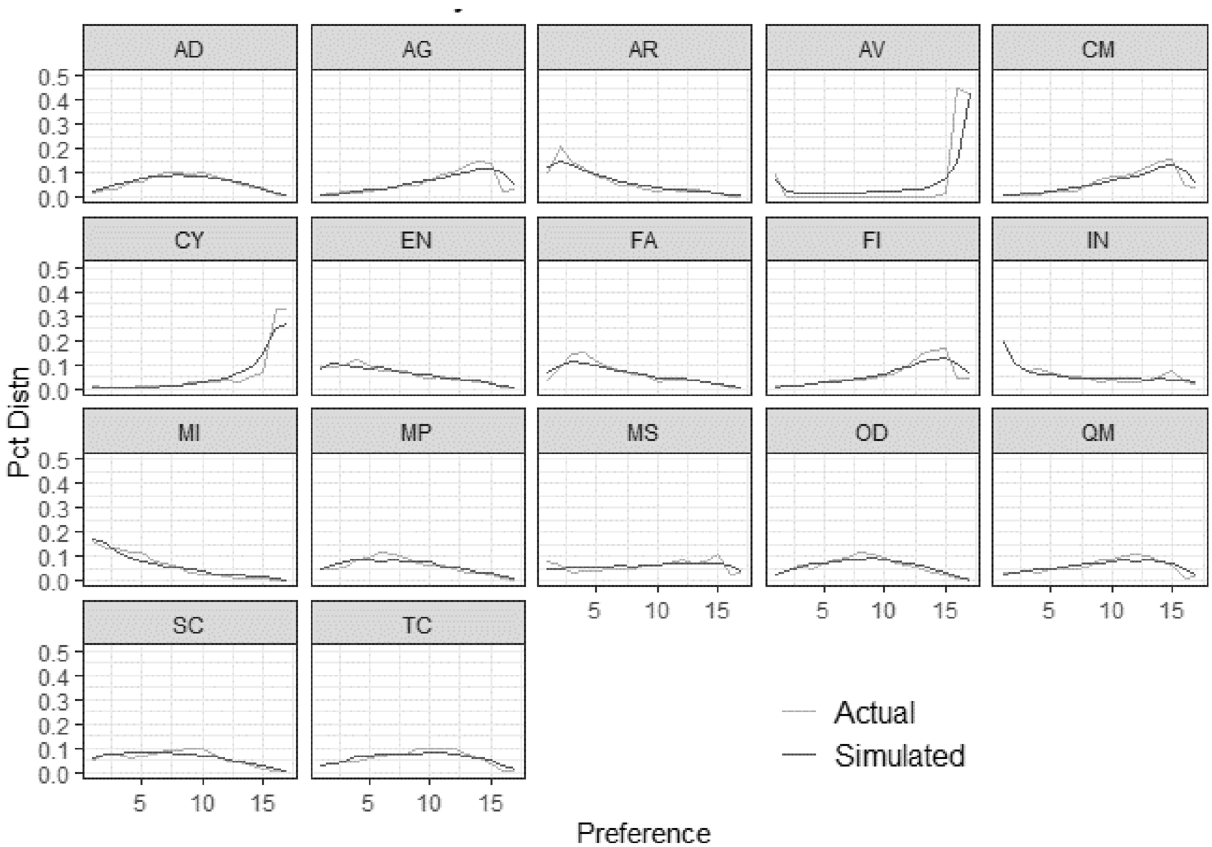


Figure D.5. Actual and simulated preference distribution by branch for male cadets.

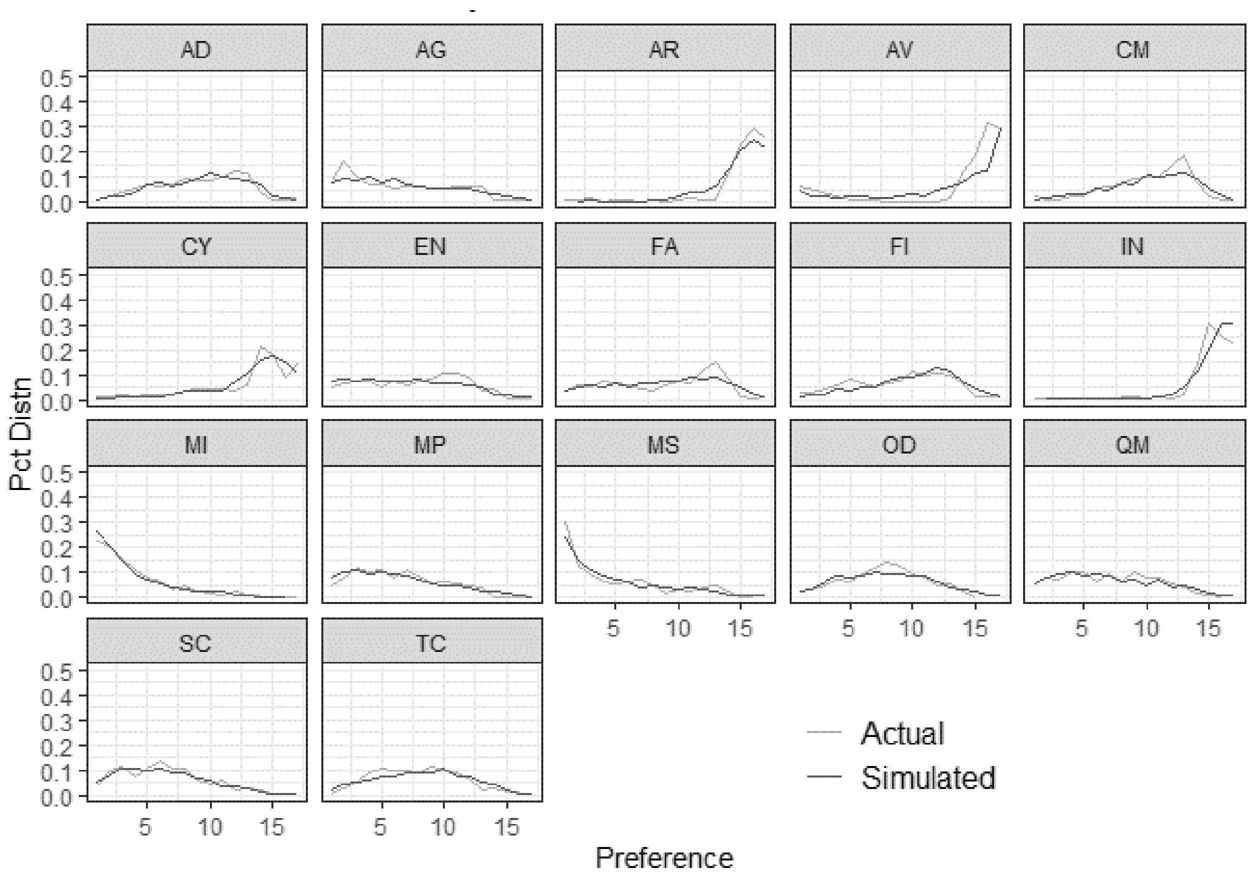


Figure D.6. Actual and simulated preference distribution by branch for female cadets.

Supplemental Simulation Results

Table D.1. Descriptive Statistics of Simulated Cadet Score Distribution by Condition

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.011	0.305	-0.523	-0.176	0.002	0.159	0.470
	1	-0.010	0.304	-0.519	-0.188	-0.012	0.171	0.493
	2	0.238	0.297	-0.172	0.010	0.200	0.427	0.784
	3	0.003	0.287	-0.460	-0.166	-0.004	0.171	0.486
	4	0.003	0.303	-0.516	-0.159	0.010	0.188	0.474
	5	0.208	0.281	-0.181	0.004	0.167	0.375	0.736
	6	0.139	0.262	-0.227	-0.039	0.104	0.291	0.623
	7	0.103	0.265	-0.276	-0.070	0.074	0.254	0.583
	8	0.151	0.300	-0.309	-0.013	0.147	0.337	0.613
Career Continuance	0	0.974	0.016	0.941	0.968	0.977	0.984	0.992
	1	0.975	0.016	0.945	0.970	0.978	0.985	0.991
	2	0.976	0.014	0.949	0.971	0.979	0.985	0.992
	3	0.974	0.016	0.943	0.969	0.978	0.986	0.992
	4	0.983	0.006	0.972	0.979	0.984	0.988	0.992
	5	0.976	0.014	0.950	0.971	0.979	0.985	0.992
	6	0.975	0.015	0.946	0.970	0.979	0.985	0.992
	7	0.975	0.015	0.945	0.970	0.978	0.985	0.992
	8	0.980	0.012	0.959	0.976	0.982	0.987	0.992
Branch Satisfaction	0	0.001	0.188	-0.295	-0.105	0.000	0.104	0.308
	1	0.007	0.187	-0.293	-0.095	0.009	0.112	0.296
	2	-0.001	0.196	-0.293	-0.121	-0.007	0.101	0.317
	3	0.198	0.225	-0.055	0.049	0.139	0.281	0.675
	4	-0.025	0.191	-0.363	-0.119	-0.012	0.084	0.255
	5	0.002	0.194	-0.293	-0.115	-0.001	0.106	0.315
	6	0.002	0.195	-0.302	-0.111	0.003	0.106	0.310
	7	0.001	0.194	-0.304	-0.108	0.002	0.105	0.303
	8	-0.024	0.189	-0.325	-0.134	-0.018	0.086	0.260
Cadet Preference	0	1.789	1.524	1.000	1.000	1.000	2.000	5.000
	1	1.528	1.129	1.000	1.000	1.000	2.000	3.000
	2	5.355	3.748	1.000	2.000	4.000	7.000	13.000
	3	5.065	3.686	1.000	2.000	4.000	7.000	13.000
	4	5.250	3.707	1.000	2.000	4.000	7.000	13.000
	5	4.918	3.757	1.000	2.000	4.000	7.000	13.000
	6	3.844	3.543	1.000	1.000	2.000	5.000	12.000
	7	3.238	3.250	1.000	1.000	2.000	4.000	11.000
	8	5.361	3.747	1.000	2.000	4.000	7.000	13.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.2. Descriptive Statistics of Actual Cadet Score Distribution by Year

Criterion	Year	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	2012_ACT	0.013	0.305	-0.465	-0.179	0.034	0.193	0.504
	2013_ACT	0.024	0.296	-0.493	-0.124	0.046	0.178	0.484
	2014_ACT	-0.028	0.312	-0.562	-0.192	-0.004	0.147	0.444
	2015_ACT	-0.028	0.293	-0.522	-0.187	-0.019	0.146	0.427
	2016_ACT	-0.017	0.285	-0.497	-0.180	-0.008	0.152	0.446
Career Continuance	2012_ACT	0.973	0.016	0.941	0.966	0.976	0.985	0.992
	2013_ACT	0.969	0.018	0.934	0.960	0.973	0.982	0.991
	2014_ACT	0.972	0.018	0.935	0.967	0.976	0.983	0.991
	2015_ACT	0.977	0.014	0.951	0.972	0.979	0.986	0.992
	2016_ACT	0.976	0.014	0.947	0.971	0.978	0.985	0.992
Branch Satisfaction	2012_ACT	-0.011	0.200	-0.318	-0.126	-0.008	0.095	0.332
	2013_ACT	-0.023	0.185	-0.303	-0.122	-0.023	0.080	0.260
	2014_ACT	-0.020	0.189	-0.322	-0.126	-0.019	0.088	0.279
	2015_ACT	0.029	0.186	-0.248	-0.081	0.027	0.131	0.334
	2016_ACT	0.013	0.181	-0.282	-0.091	0.009	0.112	0.306
Cadet Preference	2012_ACT	1.961	1.751	1.000	1.000	1.000	2.000	6.000
	2013_ACT	1.911	1.688	1.000	1.000	1.000	2.000	5.000
	2014_ACT	1.737	1.554	1.000	1.000	1.000	2.000	4.000
	2015_ACT	1.724	1.339	1.000	1.000	1.000	2.000	4.000
	2016_ACT	1.788	1.420	1.000	1.000	1.000	2.000	5.000

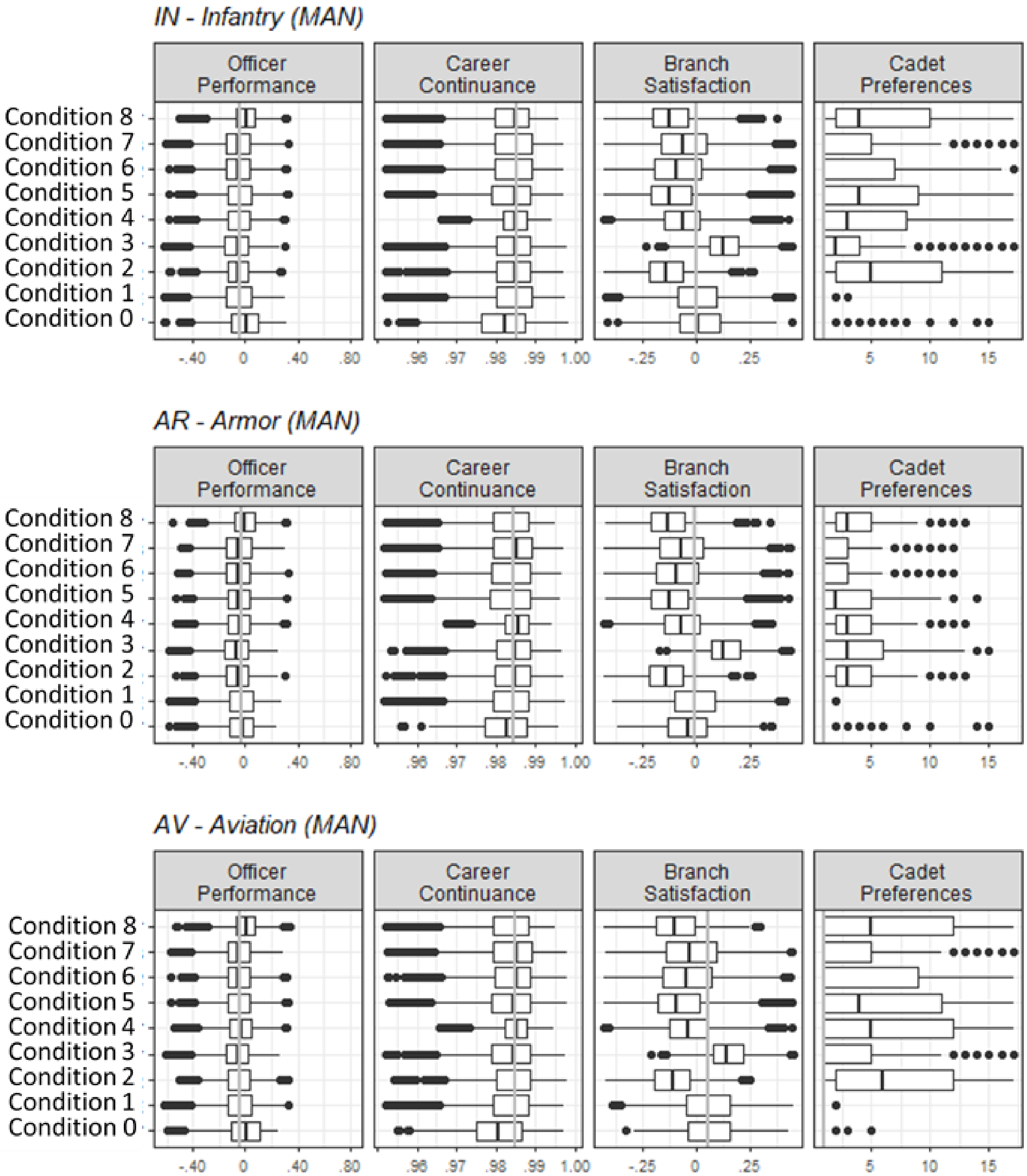
Table D.3. Descriptive Statistics of Cadet Simulated Scores for Simulated Current Condition 1 by Branching Step

Criterion	Year	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	Step-1	0.211	0.275	-0.197	0.041	0.164	0.388	0.695
	Step-2	0.138	0.260	-0.275	-0.021	0.132	0.297	0.569
	Step-3	-0.027	0.251	-0.433	-0.169	-0.033	0.110	0.399
	Step-4	-0.150	0.277	-0.631	-0.308	-0.132	0.014	0.281
Career Continuance	Step-1	0.968	0.021	0.923	0.963	0.974	0.981	0.989
	Step-2	0.969	0.018	0.934	0.961	0.973	0.981	0.989
	Step-3	0.982	0.008	0.967	0.977	0.983	0.988	0.993
	Step-4	0.979	0.012	0.956	0.974	0.981	0.987	0.992
Branch Satisfaction	Step-1	0.045	0.177	-0.226	-0.058	0.043	0.150	0.317
	Step-2	0.004	0.182	-0.287	-0.095	0.010	0.107	0.277
	Step-3	-0.003	0.181	-0.310	-0.098	0.003	0.104	0.270
	Step-4	0.004	0.194	-0.304	-0.102	0.004	0.109	0.313
Cadet Preference	Step-1	1.000	0.000	1.000	1.000	1.000	1.000	1.000
	Step-2	1.642	0.763	1.000	1.000	1.000	2.000	3.000
	Step-3	1.394	0.489	1.000	1.000	1.000	2.000	2.000
	Step-4	1.615	1.506	1.000	1.000	1.000	2.000	4.000

Results by Branch

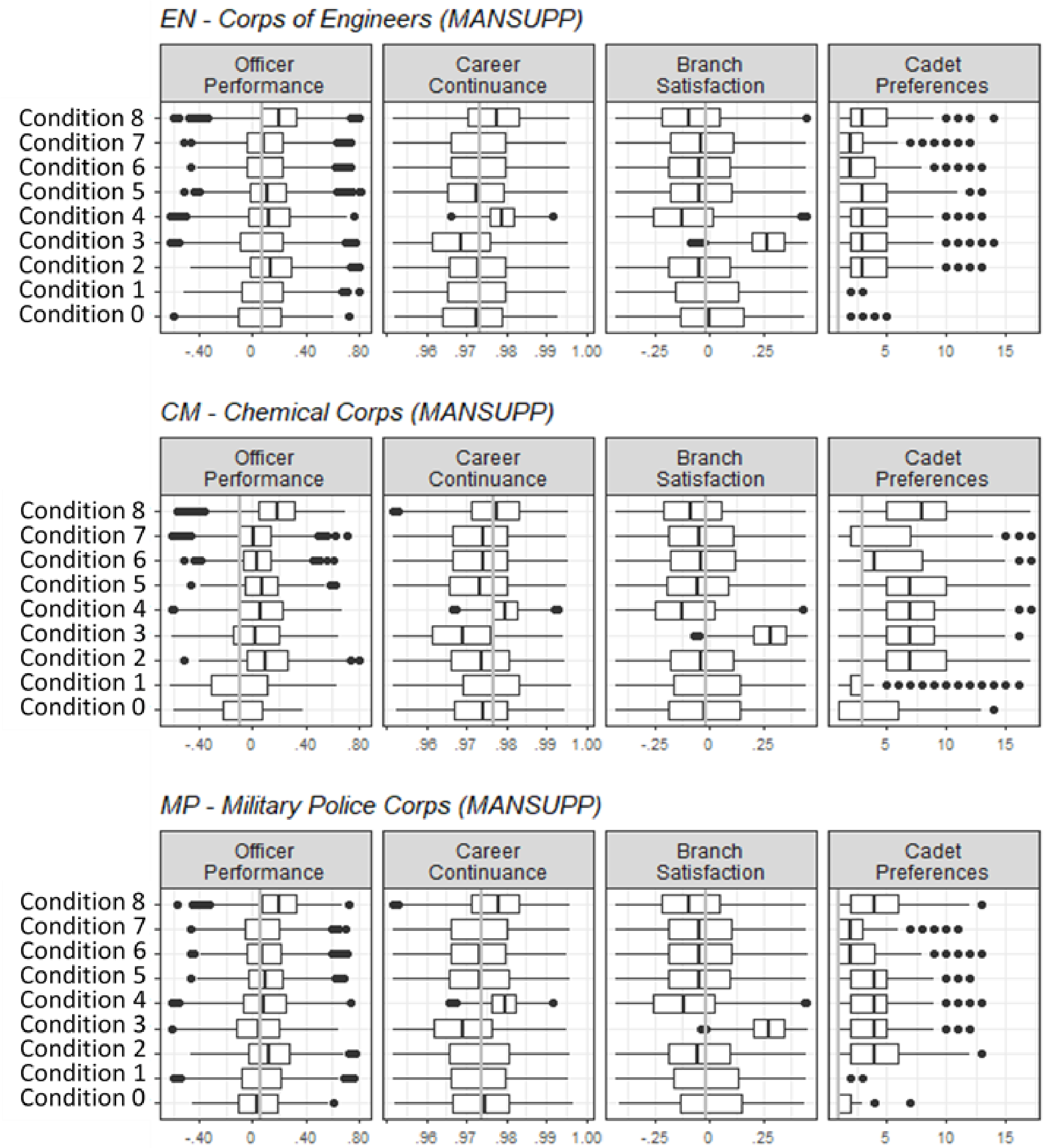
Figures D.7 through D.12 show the distribution of simulated scores by branch and condition (organized by branch cluster), with numerical values for these distributions given in Tables D.4 through D.20. As was the case for other boxplots, the gray vertical line represents the median of Condition 1.

There are several observations that can be made related to the figures. There were bigger differences between Condition 1 and Condition 0 in the branch data than in the overall data, due in part to the substantially smaller sample size, but also possibly due to differences between the branches. For most branches, the median predicted career continuance for simulated choices (Condition 1) was higher than the median prediction for actual choices (Condition 0). A similar pattern occurred for branch satisfaction, but not for as many branches. A few branches showed a counterintuitive effect of optimization in which optimization of a criterion decreased the median predicted value of that criterion. For example, optimizing performance (Condition 2) reduced the median predicted performance in Armor, compared to the current method (Condition 1). Similarly, optimizing career continuance (Condition 4) decreased career continuance for the Signal Corps and Cyber Branch.



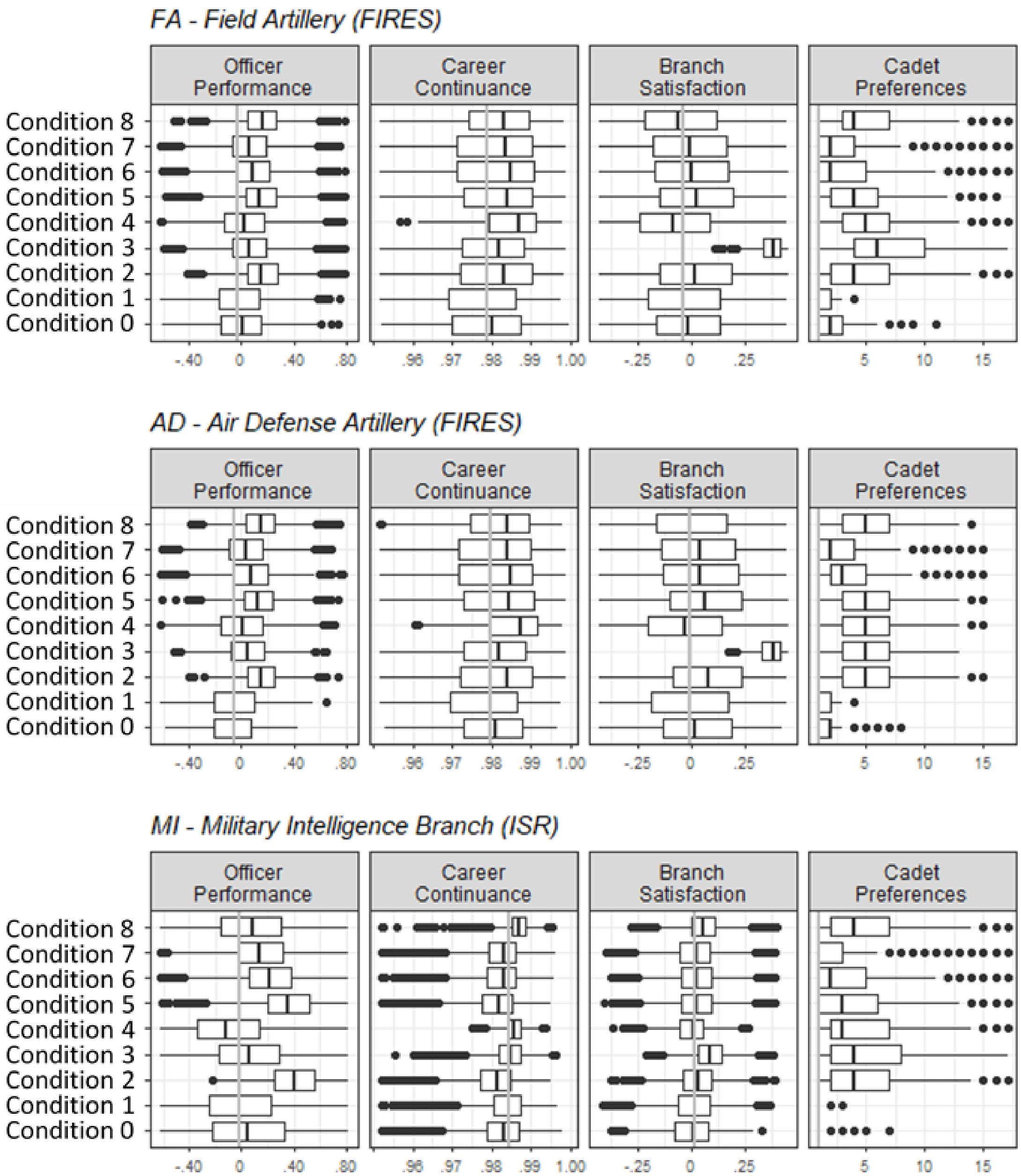
Note. ***Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.***

Figure D.7. Distribution of Cadet simulated scores by branch and condition (Maneuver Cluster).



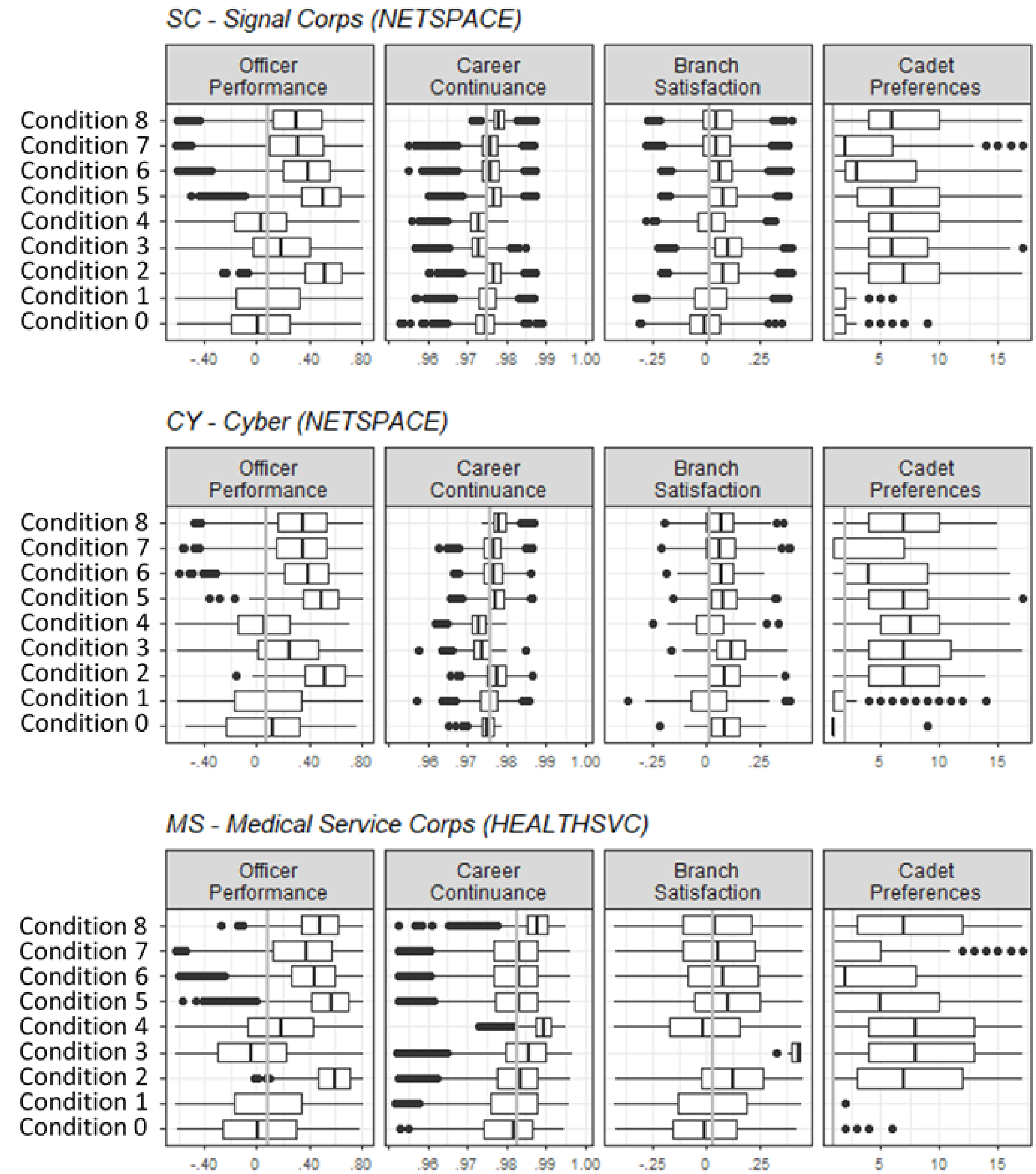
Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance

Figure D.8. Distribution of Cadet simulated scores by branch and condition (Maneuver Support Cluster).



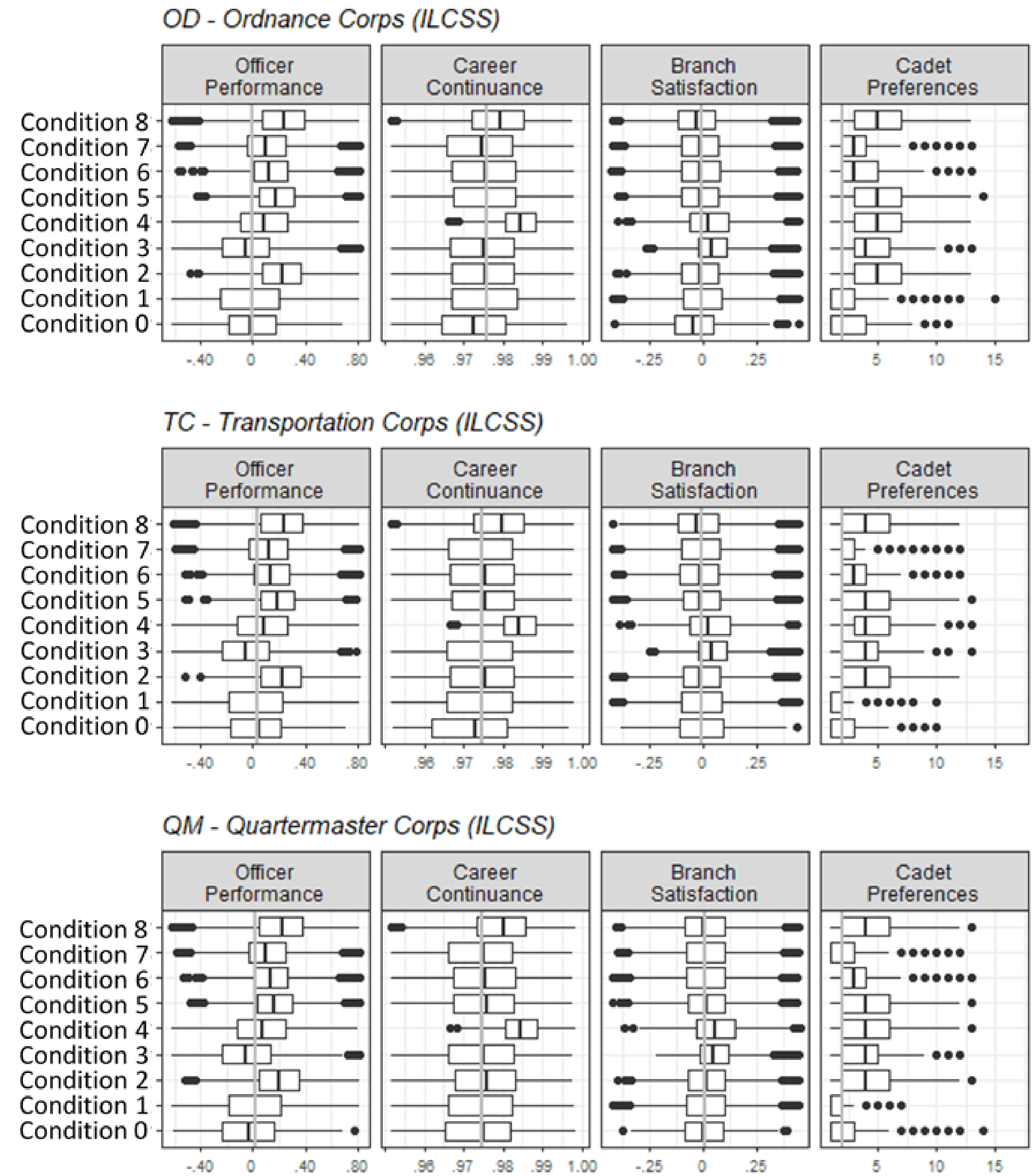
Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance

Figure D.9. Distribution of Cadet simulated scores by branch and condition (Intelligence, Surveillance, and Reconnaissance Cluster).



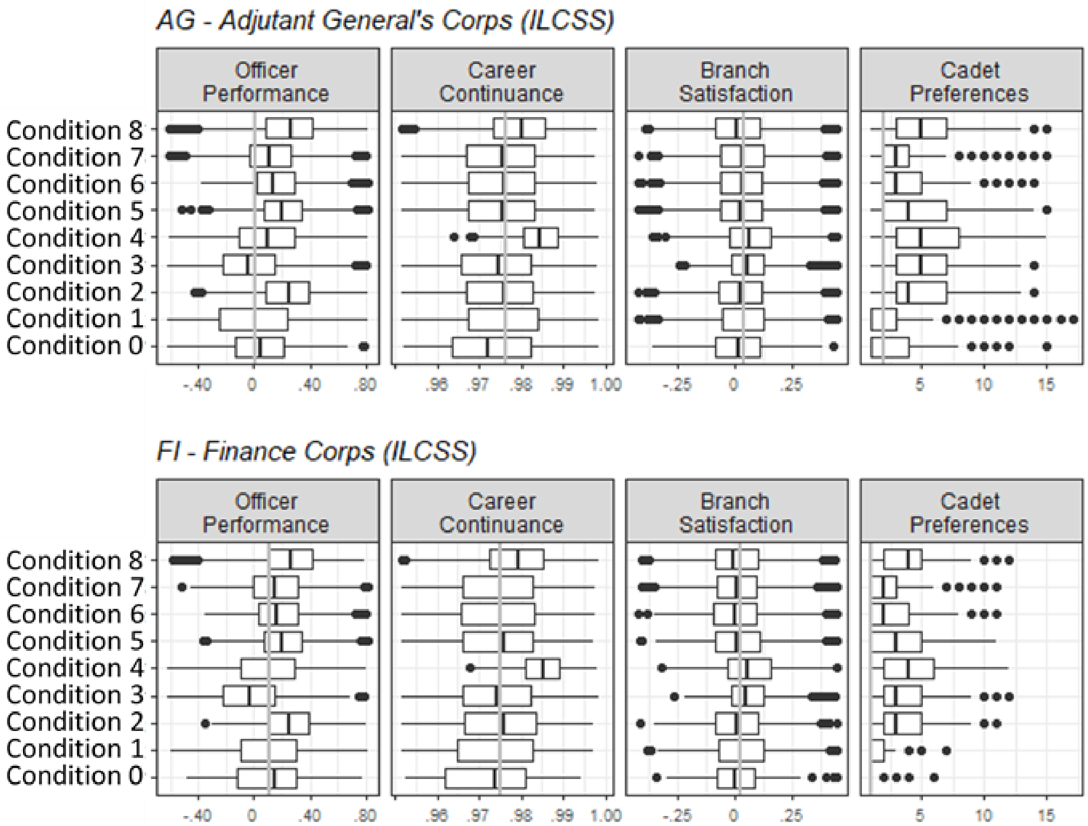
Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance

Figure D.10. Distribution of Cadet simulated scores by branch and condition (Network & Space Operations and Health Services Clusters).



Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance

Figure D.11. Distribution of Cadet simulated scores by branch and condition (Integrated Logistics Corps/Soldier Support Cluster, Part 1).



Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance

Figure D.12. Distribution of Cadet simulated scores by branch and condition (Integrated Logistics Corps/Soldier Support Cluster, Part 2).

Table D.4. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Infantry

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.013	0.145	-0.254	-0.102	0.002	0.099	0.184
	1	-0.059	0.143	-0.310	-0.148	-0.047	0.045	0.154
	2	-0.056	0.120	-0.265	-0.134	-0.050	0.027	0.134
	3	-0.071	0.134	-0.305	-0.155	-0.061	0.026	0.129
	4	-0.048	0.126	-0.269	-0.128	-0.040	0.040	0.149
	5	-0.051	0.127	-0.268	-0.137	-0.046	0.041	0.151
	6	-0.054	0.129	-0.277	-0.141	-0.050	0.038	0.152
	7	-0.057	0.133	-0.282	-0.147	-0.051	0.039	0.151
	8	-0.003	0.115	-0.206	-0.074	0.004	0.077	0.173
Career Continuance	0	0.982	0.008	0.967	0.976	0.982	0.988	0.993
	1	0.984	0.007	0.969	0.980	0.985	0.989	0.993
	2	0.984	0.007	0.971	0.980	0.985	0.989	0.993
	3	0.984	0.007	0.970	0.980	0.985	0.989	0.993
	4	0.985	0.004	0.977	0.982	0.985	0.988	0.991
	5	0.983	0.008	0.968	0.979	0.985	0.989	0.993
	6	0.984	0.008	0.969	0.980	0.985	0.989	0.993
	7	0.984	0.007	0.969	0.980	0.985	0.989	0.993
	8	0.983	0.007	0.968	0.980	0.985	0.988	0.992
Branch Satisfaction	0	0.012	0.135	-0.206	-0.079	0.010	0.109	0.234
	1	0.007	0.135	-0.215	-0.085	0.006	0.098	0.232
	2	-0.139	0.109	-0.315	-0.217	-0.141	-0.063	0.045
	3	0.133	0.101	-0.024	0.061	0.127	0.199	0.309
	4	-0.060	0.125	-0.257	-0.145	-0.064	0.021	0.154
	5	-0.109	0.138	-0.314	-0.207	-0.122	-0.025	0.141
	6	-0.077	0.152	-0.308	-0.190	-0.088	0.024	0.191
	7	-0.055	0.153	-0.299	-0.164	-0.059	0.048	0.205
	8	-0.116	0.118	-0.306	-0.198	-0.120	-0.038	0.084
Cadet Preference	0	1.219	1.094	1.000	1.000	1.000	1.000	2.000
	1	1.020	0.147	1.000	1.000	1.000	1.000	1.000
	2	6.581	5.006	1.000	2.000	5.000	11.000	16.000
	3	3.869	4.299	1.000	1.000	2.000	4.000	15.000
	4	5.220	4.751	1.000	1.000	3.000	8.000	15.000
	5	5.779	5.095	1.000	1.000	4.000	9.000	16.000
	6	4.521	4.860	1.000	1.000	1.000	7.000	15.000
	7	3.779	4.566	1.000	1.000	1.000	5.000	15.000
	8	6.222	5.133	1.000	2.000	4.000	10.000	16.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.5. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Armor

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.041	0.143	-0.310	-0.118	-0.020	0.061	0.148
	1	-0.042	0.135	-0.277	-0.125	-0.033	0.054	0.164
	2	-0.064	0.123	-0.280	-0.144	-0.057	0.020	0.130
	3	-0.079	0.135	-0.316	-0.163	-0.070	0.016	0.128
	4	-0.055	0.127	-0.279	-0.135	-0.046	0.033	0.143
	5	-0.052	0.128	-0.272	-0.139	-0.049	0.038	0.153
	6	-0.056	0.134	-0.281	-0.148	-0.051	0.039	0.157
	7	-0.055	0.134	-0.283	-0.147	-0.052	0.043	0.156
	8	-0.013	0.114	-0.216	-0.084	-0.006	0.067	0.165
Career Continuance	0	0.982	0.008	0.969	0.977	0.983	0.988	0.993
	1	0.983	0.007	0.969	0.979	0.984	0.988	0.992
	2	0.984	0.007	0.971	0.980	0.985	0.989	0.993
	3	0.984	0.007	0.970	0.980	0.985	0.989	0.993
	4	0.985	0.004	0.978	0.982	0.986	0.988	0.991
	5	0.983	0.008	0.968	0.978	0.985	0.989	0.992
	6	0.983	0.008	0.968	0.979	0.985	0.989	0.993
	7	0.983	0.008	0.968	0.979	0.985	0.989	0.993
	8	0.983	0.008	0.968	0.979	0.984	0.988	0.992
Branch Satisfaction	0	-0.036	0.135	-0.234	-0.129	-0.038	0.047	0.172
	1	-0.002	0.138	-0.220	-0.101	-0.008	0.092	0.228
	2	-0.141	0.112	-0.322	-0.217	-0.141	-0.063	0.043
	3	0.136	0.098	-0.017	0.069	0.130	0.202	0.308
	4	-0.061	0.127	-0.266	-0.146	-0.066	0.021	0.157
	5	-0.115	0.136	-0.319	-0.213	-0.124	-0.033	0.130
	6	-0.082	0.149	-0.308	-0.189	-0.090	0.012	0.182
	7	-0.065	0.151	-0.303	-0.174	-0.070	0.033	0.199
	8	-0.127	0.118	-0.313	-0.211	-0.131	-0.050	0.075
Cadet Preference	0	1.436	1.460	1.000	1.000	1.000	1.000	3.000
	1	1.001	0.033	1.000	1.000	1.000	1.000	1.000
	2	3.727	2.487	1.000	2.000	3.000	5.000	9.000
	3	4.075	3.290	1.000	1.000	3.000	6.000	11.000
	4	3.749	2.691	1.000	2.000	3.000	5.000	9.000
	5	3.139	2.404	1.000	1.000	2.000	5.000	8.000
	6	2.516	2.211	1.000	1.000	1.000	3.000	7.550
	7	2.154	2.017	1.000	1.000	1.000	3.000	7.000
	8	3.810	2.655	1.000	2.000	3.000	5.000	9.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.6. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Aviation

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.011	0.153	-0.299	-0.112	0.008	0.109	0.198
	1	-0.055	0.142	-0.301	-0.136	-0.046	0.045	0.158
	2	-0.052	0.119	-0.261	-0.127	-0.043	0.028	0.133
	3	-0.067	0.133	-0.301	-0.149	-0.056	0.027	0.131
	4	-0.040	0.126	-0.260	-0.120	-0.030	0.047	0.154
	5	-0.049	0.130	-0.276	-0.131	-0.042	0.039	0.158
	6	-0.054	0.128	-0.265	-0.138	-0.052	0.032	0.159
	7	-0.053	0.134	-0.279	-0.138	-0.051	0.040	0.161
	8	0.000	0.113	-0.200	-0.068	0.006	0.076	0.174
Career Continuance	0	0.980	0.008	0.965	0.975	0.981	0.986	0.992
	1	0.983	0.008	0.967	0.979	0.985	0.988	0.993
	2	0.984	0.007	0.971	0.980	0.985	0.989	0.993
	3	0.983	0.007	0.970	0.979	0.984	0.989	0.993
	4	0.985	0.004	0.978	0.982	0.985	0.988	0.991
	5	0.983	0.008	0.968	0.979	0.985	0.989	0.993
	6	0.983	0.008	0.968	0.980	0.985	0.989	0.993
	7	0.983	0.008	0.968	0.979	0.985	0.989	0.993
	8	0.983	0.007	0.969	0.979	0.985	0.988	0.992
Branch Satisfaction	0	0.058	0.141	-0.179	-0.035	0.054	0.157	0.291
	1	0.059	0.148	-0.189	-0.043	0.057	0.162	0.300
	2	-0.112	0.115	-0.307	-0.192	-0.109	-0.030	0.072
	3	0.151	0.105	-0.014	0.077	0.145	0.221	0.331
	4	-0.032	0.135	-0.249	-0.126	-0.034	0.059	0.194
	5	-0.077	0.151	-0.307	-0.181	-0.088	0.014	0.203
	6	-0.038	0.166	-0.298	-0.155	-0.047	0.071	0.256
	7	-0.018	0.165	-0.282	-0.136	-0.026	0.095	0.268
	8	-0.095	0.123	-0.295	-0.183	-0.096	-0.006	0.112
Cadet Preference	0	1.048	0.376	1.000	1.000	1.000	1.000	1.000
	1	1.007	0.085	1.000	1.000	1.000	1.000	1.000
	2	7.032	5.369	1.000	2.000	6.000	12.000	16.000
	3	3.727	4.278	1.000	1.000	1.000	5.000	14.000
	4	6.596	5.471	1.000	1.000	5.000	12.000	16.000
	5	6.048	5.466	1.000	1.000	4.000	11.000	15.000
	6	4.910	5.251	1.000	1.000	1.000	9.000	15.000
	7	3.888	4.770	1.000	1.000	1.000	5.000	15.000
	8	6.676	5.282	1.000	1.000	5.000	12.000	15.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.7. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Engineers

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.048	0.241	-0.389	-0.109	0.069	0.215	0.403
	1	0.077	0.208	-0.252	-0.076	0.069	0.226	0.431
	2	0.141	0.206	-0.191	-0.015	0.139	0.287	0.477
	3	0.061	0.226	-0.328	-0.090	0.077	0.221	0.408
	4	0.110	0.226	-0.283	-0.037	0.118	0.273	0.466
	5	0.120	0.186	-0.177	-0.013	0.117	0.248	0.430
	6	0.096	0.193	-0.197	-0.043	0.079	0.224	0.437
	7	0.093	0.193	-0.210	-0.044	0.080	0.225	0.423
	8	0.196	0.192	-0.129	0.068	0.205	0.335	0.494
Career Continuance	0	0.966	0.017	0.936	0.959	0.969	0.978	0.987
	1	0.969	0.014	0.942	0.962	0.972	0.979	0.987
	2	0.969	0.015	0.941	0.962	0.971	0.979	0.988
	3	0.961	0.017	0.928	0.952	0.964	0.973	0.983
	4	0.979	0.004	0.972	0.976	0.979	0.982	0.986
	5	0.969	0.014	0.942	0.961	0.971	0.978	0.988
	6	0.970	0.014	0.943	0.963	0.972	0.979	0.988
	7	0.970	0.014	0.943	0.963	0.972	0.979	0.987
	8	0.974	0.014	0.947	0.968	0.977	0.983	0.990
Branch Satisfaction	0	0.015	0.220	-0.333	-0.139	0.006	0.165	0.364
	1	-0.014	0.238	-0.393	-0.172	-0.017	0.142	0.385
	2	-0.047	0.223	-0.404	-0.200	-0.052	0.098	0.328
	3	0.319	0.148	0.109	0.214	0.301	0.405	0.590
	4	-0.145	0.223	-0.499	-0.301	-0.150	0.002	0.230
	5	-0.045	0.227	-0.407	-0.200	-0.050	0.103	0.332
	6	-0.048	0.232	-0.417	-0.206	-0.053	0.102	0.343
	7	-0.045	0.227	-0.412	-0.200	-0.048	0.109	0.332
	8	-0.097	0.220	-0.445	-0.245	-0.102	0.042	0.270
Cadet Preference	0	1.249	0.623	1.000	1.000	1.000	1.000	3.000
	1	1.146	0.354	1.000	1.000	1.000	1.000	2.000
	2	3.743	2.252	1.000	2.000	3.000	5.000	8.000
	3	3.914	2.390	1.000	2.000	3.000	5.000	9.000
	4	3.855	2.296	1.000	2.000	3.000	5.000	8.000
	5	3.394	2.305	1.000	1.000	3.000	5.000	8.000
	6	2.737	2.188	1.000	1.000	2.000	4.000	7.000
	7	2.367	2.029	1.000	1.000	2.000	3.000	7.000
	8	3.829	2.229	1.000	2.000	3.000	5.000	8.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.8. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Chemical Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.097	0.228	-0.489	-0.242	-0.100	0.069	0.276
	1	-0.116	0.279	-0.567	-0.337	-0.101	0.104	0.311
	2	0.109	0.202	-0.200	-0.044	0.101	0.259	0.450
	3	0.020	0.238	-0.380	-0.142	0.023	0.200	0.397
	4	0.058	0.241	-0.359	-0.098	0.064	0.230	0.443
	5	0.065	0.169	-0.226	-0.054	0.073	0.186	0.330
	6	0.038	0.160	-0.221	-0.066	0.032	0.141	0.312
	7	0.014	0.186	-0.289	-0.105	0.012	0.134	0.321
	8	0.177	0.196	-0.157	0.048	0.190	0.317	0.474
Career Continuance	0	0.968	0.019	0.933	0.961	0.972	0.980	0.988
	1	0.973	0.014	0.947	0.966	0.975	0.983	0.989
	2	0.969	0.014	0.943	0.962	0.972	0.979	0.989
	3	0.961	0.017	0.928	0.952	0.964	0.974	0.984
	4	0.980	0.004	0.972	0.977	0.980	0.983	0.986
	5	0.970	0.014	0.943	0.963	0.972	0.979	0.988
	6	0.971	0.013	0.946	0.964	0.973	0.980	0.988
	7	0.971	0.013	0.947	0.964	0.973	0.980	0.988
	8	0.974	0.013	0.949	0.969	0.977	0.983	0.990
Branch Satisfaction	0	-0.003	0.277	-0.394	-0.196	-0.019	0.154	0.450
	1	-0.016	0.261	-0.447	-0.190	-0.020	0.156	0.424
	2	-0.041	0.235	-0.416	-0.200	-0.045	0.112	0.359
	3	0.339	0.158	0.123	0.227	0.319	0.421	0.627
	4	-0.135	0.228	-0.490	-0.295	-0.146	0.011	0.254
	5	-0.053	0.226	-0.408	-0.210	-0.057	0.092	0.344
	6	-0.035	0.241	-0.422	-0.197	-0.041	0.121	0.382
	7	-0.043	0.246	-0.428	-0.209	-0.053	0.117	0.372
	8	-0.082	0.223	-0.438	-0.232	-0.094	0.058	0.283
Cadet Preference	0	3.796	2.985	1.000	1.000	3.000	6.000	9.000
	1	3.119	2.199	1.000	2.000	3.000	3.000	8.000
	2	7.404	3.332	2.000	5.000	7.000	10.000	13.000
	3	7.066	3.260	2.000	5.000	7.000	9.000	13.000
	4	7.104	3.262	2.000	5.000	7.000	9.000	13.000
	5	7.429	3.419	2.000	5.000	7.000	10.000	13.000
	6	5.392	3.640	1.000	3.000	4.000	8.000	12.000
	7	4.639	3.499	1.000	2.000	3.000	7.000	12.000
	8	7.812	3.389	2.000	5.000	8.000	10.000	14.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.9. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Military Police Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.038	0.214	-0.298	-0.105	0.038	0.183	0.366
	1	0.065	0.211	-0.274	-0.086	0.060	0.213	0.419
	2	0.128	0.203	-0.193	-0.025	0.122	0.273	0.473
	3	0.033	0.231	-0.350	-0.123	0.040	0.199	0.398
	4	0.083	0.231	-0.313	-0.072	0.091	0.246	0.455
	5	0.104	0.185	-0.193	-0.027	0.099	0.232	0.419
	6	0.086	0.189	-0.206	-0.048	0.071	0.210	0.416
	7	0.080	0.190	-0.211	-0.055	0.065	0.205	0.422
	8	0.198	0.187	-0.116	0.071	0.202	0.332	0.493
Career Continuance	0	0.969	0.016	0.937	0.962	0.972	0.980	0.988
	1	0.970	0.014	0.944	0.963	0.972	0.979	0.987
	2	0.970	0.014	0.943	0.963	0.972	0.980	0.989
	3	0.962	0.017	0.928	0.953	0.965	0.974	0.983
	4	0.980	0.004	0.972	0.976	0.980	0.983	0.986
	5	0.970	0.014	0.943	0.962	0.972	0.980	0.989
	6	0.970	0.014	0.944	0.963	0.972	0.979	0.988
	7	0.970	0.014	0.944	0.963	0.972	0.979	0.988
	8	0.975	0.013	0.949	0.969	0.977	0.983	0.990
Branch Satisfaction	0	0.011	0.234	-0.337	-0.141	-0.010	0.165	0.412
	1	-0.015	0.237	-0.400	-0.177	-0.020	0.145	0.378
	2	-0.047	0.227	-0.407	-0.202	-0.056	0.101	0.337
	3	0.330	0.147	0.125	0.224	0.311	0.418	0.603
	4	-0.141	0.230	-0.512	-0.301	-0.145	0.011	0.246
	5	-0.044	0.226	-0.401	-0.199	-0.048	0.100	0.335
	6	-0.044	0.234	-0.416	-0.208	-0.050	0.109	0.350
	7	-0.044	0.235	-0.418	-0.202	-0.049	0.105	0.350
	8	-0.096	0.220	-0.444	-0.244	-0.104	0.044	0.289
Cadet Preference	0	1.360	0.675	1.000	1.000	1.000	2.000	3.000
	1	1.174	0.384	1.000	1.000	1.000	1.000	2.000
	2	4.208	2.353	1.000	2.000	4.000	6.000	9.000
	3	3.913	2.283	1.000	2.000	4.000	5.000	8.000
	4	3.911	2.272	1.000	2.000	4.000	5.000	8.000
	5	3.883	2.366	1.000	2.000	4.000	5.000	8.000
	6	3.023	2.364	1.000	1.000	2.000	4.000	8.000
	7	2.535	2.100	1.000	1.000	2.000	3.000	7.000
	8	4.265	2.334	1.000	2.000	4.000	6.000	9.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.10. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Field Artillery

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.010	0.241	-0.423	-0.162	0.002	0.146	0.352
	1	-0.029	0.229	-0.415	-0.178	-0.027	0.128	0.335
	2	0.164	0.166	-0.089	0.047	0.153	0.272	0.446
	3	0.062	0.195	-0.255	-0.068	0.060	0.190	0.380
	4	0.016	0.236	-0.385	-0.139	0.021	0.177	0.391
	5	0.149	0.176	-0.123	0.030	0.142	0.263	0.446
	6	0.081	0.203	-0.261	-0.043	0.084	0.214	0.408
	7	0.056	0.204	-0.291	-0.072	0.058	0.191	0.385
	8	0.164	0.164	-0.092	0.053	0.159	0.268	0.446
Career Continuance	0	0.976	0.015	0.949	0.967	0.979	0.987	0.994
	1	0.971	0.020	0.930	0.962	0.976	0.985	0.991
	2	0.979	0.014	0.954	0.971	0.982	0.990	0.995
	3	0.975	0.018	0.940	0.968	0.980	0.988	0.994
	4	0.985	0.007	0.972	0.979	0.987	0.991	0.995
	5	0.976	0.020	0.936	0.969	0.982	0.990	0.995
	6	0.974	0.021	0.933	0.963	0.982	0.990	0.995
	7	0.974	0.021	0.933	0.963	0.981	0.990	0.995
	8	0.981	0.011	0.959	0.974	0.983	0.989	0.994
Branch Satisfaction	0	-0.033	0.305	-0.516	-0.212	-0.022	0.156	0.495
	1	-0.075	0.309	-0.593	-0.282	-0.065	0.136	0.426
	2	0.035	0.299	-0.449	-0.166	0.032	0.232	0.537
	3	0.509	0.154	0.299	0.400	0.486	0.593	0.799
	4	-0.150	0.314	-0.671	-0.360	-0.144	0.063	0.367
	5	0.036	0.300	-0.455	-0.167	0.035	0.234	0.539
	6	-0.006	0.313	-0.520	-0.214	-0.001	0.203	0.513
	7	-0.028	0.315	-0.561	-0.237	-0.022	0.188	0.482
	8	-0.094	0.303	-0.583	-0.304	-0.093	0.105	0.401
Cadet Preference	0	2.072	1.233	1.000	1.000	2.000	3.000	4.000
	1	1.329	0.520	1.000	1.000	1.000	2.000	2.000
	2	4.839	2.999	1.000	2.000	4.000	7.000	11.000
	3	6.807	3.844	1.000	4.000	6.000	10.000	13.000
	4	5.239	3.241	1.000	3.000	5.000	7.000	12.000
	5	4.552	3.043	1.000	2.000	4.000	6.000	10.050
	6	3.456	2.904	1.000	1.000	2.000	5.000	10.000
	7	2.929	2.653	1.000	1.000	2.000	4.000	9.000
	8	4.882	3.007	1.000	3.000	4.000	7.000	11.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.11. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Air Defense Artillery

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.080	0.214	-0.460	-0.216	-0.061	0.071	0.245
	1	-0.062	0.226	-0.439	-0.215	-0.056	0.099	0.294
	2	0.155	0.164	-0.099	0.041	0.144	0.258	0.448
	3	0.045	0.192	-0.273	-0.083	0.044	0.173	0.363
	4	-0.005	0.237	-0.413	-0.156	0.006	0.156	0.367
	5	0.137	0.168	-0.116	0.023	0.128	0.244	0.420
	6	0.062	0.200	-0.282	-0.058	0.066	0.194	0.374
	7	0.031	0.203	-0.327	-0.091	0.035	0.166	0.361
	8	0.149	0.161	-0.096	0.038	0.146	0.250	0.421
Career Continuance	0	0.976	0.015	0.949	0.970	0.980	0.987	0.993
	1	0.972	0.019	0.935	0.963	0.977	0.986	0.992
	2	0.980	0.013	0.955	0.971	0.983	0.990	0.995
	3	0.975	0.018	0.940	0.969	0.981	0.988	0.994
	4	0.986	0.007	0.972	0.980	0.988	0.992	0.995
	5	0.978	0.017	0.950	0.971	0.983	0.990	0.995
	6	0.975	0.020	0.937	0.965	0.983	0.990	0.995
	7	0.974	0.021	0.933	0.965	0.982	0.989	0.995
	8	0.981	0.011	0.960	0.974	0.984	0.990	0.994
Branch Satisfaction	0	0.017	0.311	-0.523	-0.161	0.019	0.225	0.532
	1	-0.010	0.315	-0.533	-0.234	-0.009	0.203	0.502
	2	0.124	0.301	-0.376	-0.075	0.121	0.333	0.621
	3	0.520	0.158	0.304	0.405	0.498	0.611	0.814
	4	-0.067	0.323	-0.605	-0.280	-0.069	0.148	0.449
	5	0.108	0.304	-0.390	-0.095	0.105	0.307	0.611
	6	0.064	0.315	-0.458	-0.146	0.062	0.279	0.582
	7	0.048	0.320	-0.479	-0.165	0.056	0.261	0.567
	8	-0.014	0.294	-0.497	-0.208	-0.011	0.189	0.462
Cadet Preference	0	1.971	1.225	1.000	1.000	2.000	2.000	4.000
	1	1.496	0.642	1.000	1.000	1.000	2.000	3.000
	2	5.270	2.788	1.000	3.000	5.000	7.000	11.000
	3	5.334	2.716	1.000	3.000	5.000	7.000	10.000
	4	5.335	2.866	1.000	3.000	5.000	7.000	10.000
	5	5.132	2.938	1.000	3.000	5.000	7.000	10.550
	6	3.785	2.774	1.000	2.000	3.000	5.000	9.000
	7	3.211	2.570	1.000	1.000	2.000	4.000	9.000
	8	5.418	2.817	1.000	3.000	5.000	7.000	11.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.12. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Military Intelligence

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.028	0.461	-0.843	-0.322	0.006	0.306	0.644
	1	-0.067	0.403	-0.746	-0.333	-0.061	0.213	0.583
	2	0.435	0.241	0.052	0.264	0.424	0.599	0.845
	3	0.042	0.367	-0.577	-0.202	0.048	0.290	0.645
	4	-0.211	0.415	-0.914	-0.494	-0.204	0.088	0.454
	5	0.376	0.250	0.005	0.207	0.364	0.540	0.792
	6	0.215	0.282	-0.251	0.054	0.211	0.389	0.672
	7	0.134	0.308	-0.399	-0.041	0.135	0.325	0.633
	8	-0.042	0.440	-0.900	-0.293	0.029	0.278	0.564
Career Continuance	0	0.981	0.011	0.964	0.979	0.983	0.987	0.991
	1	0.983	0.006	0.973	0.981	0.984	0.987	0.991
	2	0.980	0.006	0.968	0.977	0.982	0.985	0.988
	3	0.984	0.005	0.976	0.982	0.985	0.987	0.990
	4	0.986	0.003	0.981	0.984	0.986	0.988	0.990
	5	0.981	0.006	0.969	0.978	0.982	0.985	0.989
	6	0.982	0.006	0.971	0.979	0.983	0.986	0.989
	7	0.982	0.006	0.970	0.979	0.983	0.986	0.990
	8	0.987	0.003	0.981	0.985	0.987	0.989	0.991
Branch Satisfaction	0	-0.004	0.118	-0.224	-0.077	0.011	0.080	0.171
	1	0.014	0.110	-0.172	-0.058	0.018	0.088	0.191
	2	0.028	0.099	-0.140	-0.036	0.031	0.094	0.188
	3	0.090	0.082	-0.043	0.035	0.088	0.146	0.228
	4	0.000	0.086	-0.154	-0.054	0.007	0.060	0.131
	5	0.024	0.102	-0.149	-0.041	0.028	0.092	0.188
	6	0.025	0.105	-0.154	-0.043	0.029	0.095	0.193
	7	0.020	0.106	-0.161	-0.049	0.023	0.091	0.193
	8	0.060	0.084	-0.078	0.004	0.059	0.114	0.201
Cadet Preference	0	1.216	0.564	1.000	1.000	1.000	1.000	2.000
	1	1.117	0.323	1.000	1.000	1.000	1.000	2.000
	2	5.013	3.765	1.000	2.000	4.000	7.000	13.000
	3	5.345	3.831	1.000	2.000	4.000	8.000	13.000
	4	4.730	3.757	1.000	2.000	3.000	7.000	13.000
	5	4.437	3.759	1.000	1.000	3.000	6.000	12.000
	6	3.606	3.619	1.000	1.000	2.000	5.000	12.000
	7	2.925	3.210	1.000	1.000	1.000	3.000	10.000
	8	4.999	3.860	1.000	2.000	4.000	7.000	13.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.13. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Signal

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.010	0.371	-0.633	-0.258	-0.018	0.240	0.630
	1	0.075	0.367	-0.538	-0.180	0.076	0.329	0.673
	2	0.554	0.229	0.177	0.393	0.560	0.718	0.924
	3	0.193	0.328	-0.354	-0.026	0.200	0.420	0.729
	4	0.006	0.297	-0.515	-0.191	0.023	0.220	0.464
	5	0.527	0.234	0.143	0.369	0.539	0.692	0.891
	6	0.377	0.297	-0.184	0.205	0.410	0.588	0.807
	7	0.300	0.316	-0.273	0.106	0.326	0.527	0.764
	8	0.310	0.277	-0.163	0.127	0.318	0.505	0.750
Career Continuance	0	0.974	0.005	0.966	0.972	0.975	0.977	0.980
	1	0.975	0.003	0.969	0.973	0.975	0.977	0.980
	2	0.977	0.003	0.972	0.975	0.977	0.979	0.982
	3	0.973	0.003	0.967	0.971	0.973	0.975	0.977
	4	0.972	0.003	0.967	0.971	0.973	0.975	0.977
	5	0.977	0.003	0.971	0.975	0.977	0.979	0.982
	6	0.976	0.003	0.970	0.974	0.976	0.978	0.981
	7	0.976	0.003	0.970	0.974	0.976	0.978	0.981
	8	0.978	0.002	0.975	0.977	0.978	0.979	0.982
Branch Satisfaction	0	-0.005	0.106	-0.178	-0.077	-0.008	0.068	0.160
	1	0.019	0.107	-0.157	-0.054	0.021	0.094	0.192
	2	0.083	0.093	-0.070	0.019	0.082	0.148	0.236
	3	0.105	0.091	-0.044	0.042	0.105	0.169	0.254
	4	0.024	0.092	-0.128	-0.040	0.025	0.089	0.175
	5	0.079	0.091	-0.071	0.017	0.079	0.142	0.225
	6	0.065	0.085	-0.074	0.008	0.064	0.120	0.207
	7	0.051	0.094	-0.104	-0.012	0.051	0.114	0.208
	8	0.053	0.095	-0.101	-0.012	0.052	0.118	0.212
Cadet Preference	0	1.742	0.969	1.000	1.000	1.000	2.000	3.000
	1	1.604	0.741	1.000	1.000	1.000	2.000	3.000
	2	7.122	3.944	1.000	4.000	7.000	10.000	14.000
	3	6.731	3.693	1.000	4.000	6.000	9.000	13.000
	4	6.776	3.842	1.000	4.000	6.000	10.000	14.000
	5	6.742	4.014	1.000	3.000	6.000	10.000	14.000
	6	4.962	4.064	1.000	2.000	3.000	8.000	13.000
	7	4.092	3.816	1.000	1.000	2.000	6.000	13.000
	8	6.777	3.925	1.000	4.000	6.000	10.000	14.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.14. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Cyber

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.060	0.425	-0.533	-0.237	0.119	0.354	0.707
	1	0.076	0.378	-0.539	-0.187	0.067	0.350	0.715
	2	0.564	0.233	0.177	0.408	0.570	0.734	0.911
	3	0.254	0.341	-0.317	0.008	0.264	0.497	0.805
	4	0.033	0.306	-0.545	-0.160	0.051	0.253	0.504
	5	0.524	0.235	0.126	0.363	0.531	0.691	0.899
	6	0.402	0.295	-0.123	0.227	0.416	0.611	0.855
	7	0.354	0.307	-0.158	0.169	0.376	0.574	0.828
	8	0.352	0.275	-0.115	0.171	0.361	0.550	0.755
Career Continuance	0	0.975	0.003	0.968	0.974	0.975	0.977	0.979
	1	0.976	0.004	0.970	0.974	0.976	0.978	0.982
	2	0.978	0.003	0.972	0.975	0.977	0.980	0.984
	3	0.973	0.003	0.968	0.972	0.974	0.975	0.978
	4	0.973	0.003	0.967	0.971	0.973	0.975	0.977
	5	0.977	0.003	0.972	0.975	0.977	0.979	0.984
	6	0.977	0.003	0.970	0.974	0.977	0.979	0.982
	7	0.976	0.003	0.971	0.974	0.977	0.979	0.982
	8	0.978	0.002	0.975	0.977	0.978	0.980	0.983
Branch Satisfaction	0	0.087	0.108	-0.091	0.026	0.086	0.158	0.224
	1	0.018	0.121	-0.177	-0.072	0.018	0.099	0.217
	2	0.090	0.097	-0.058	0.017	0.090	0.155	0.259
	3	0.118	0.098	-0.048	0.049	0.119	0.185	0.267
	4	0.020	0.089	-0.121	-0.048	0.020	0.083	0.165
	5	0.087	0.089	-0.052	0.028	0.082	0.145	0.240
	6	0.072	0.079	-0.054	0.018	0.071	0.126	0.207
	7	0.070	0.102	-0.097	-0.001	0.067	0.136	0.242
	8	0.068	0.096	-0.085	0.003	0.069	0.131	0.231
Cadet Preference	0	1.222	1.333	1.000	1.000	1.000	1.000	1.000
	1	2.049	1.799	1.000	1.000	2.000	2.000	5.000
	2	6.856	3.507	1.000	4.000	7.000	10.000	13.000
	3	7.467	3.995	1.000	4.000	7.000	11.000	14.000
	4	7.600	3.556	2.000	5.000	7.500	10.000	13.000
	5	6.689	3.704	1.000	4.000	7.000	9.000	13.000
	6	5.129	3.944	1.000	2.000	4.000	9.000	13.000
	7	4.440	3.868	1.000	1.000	2.000	7.000	12.000
	8	6.998	3.559	1.000	4.000	7.000	10.000	13.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.15. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Medical Service Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.025	0.440	-0.762	-0.364	-0.023	0.298	0.718
	1	0.097	0.434	-0.601	-0.195	0.086	0.387	0.839
	2	0.754	0.269	0.346	0.558	0.740	0.927	1.223
	3	-0.117	0.475	-0.919	-0.440	-0.113	0.206	0.666
	4	0.222	0.431	-0.476	-0.073	0.218	0.507	0.934
	5	0.660	0.305	0.146	0.485	0.667	0.850	1.137
	6	0.463	0.345	-0.162	0.291	0.487	0.677	0.976
	7	0.375	0.398	-0.368	0.153	0.425	0.640	0.947
	8	0.568	0.280	0.152	0.373	0.547	0.744	1.059
Career Continuance	0	0.979	0.010	0.960	0.974	0.982	0.987	0.991
	1	0.980	0.010	0.961	0.975	0.982	0.988	0.992
	2	0.982	0.008	0.966	0.978	0.984	0.988	0.992
	3	0.984	0.008	0.968	0.980	0.986	0.990	0.994
	4	0.989	0.003	0.984	0.987	0.990	0.991	0.993
	5	0.981	0.009	0.964	0.977	0.983	0.988	0.992
	6	0.981	0.009	0.964	0.977	0.983	0.988	0.992
	7	0.981	0.009	0.964	0.977	0.983	0.988	0.993
	8	0.987	0.005	0.980	0.985	0.988	0.990	0.993
Branch Satisfaction	0	0.012	0.283	-0.408	-0.171	0.002	0.168	0.511
	1	0.081	0.308	-0.393	-0.129	0.063	0.270	0.630
	2	0.251	0.318	-0.219	0.027	0.213	0.450	0.822
	3	0.795	0.179	0.546	0.667	0.773	0.894	1.135
	4	0.041	0.294	-0.386	-0.173	0.009	0.223	0.575
	5	0.221	0.322	-0.248	-0.006	0.181	0.422	0.796
	6	0.196	0.331	-0.290	-0.042	0.162	0.407	0.781
	7	0.161	0.338	-0.334	-0.078	0.119	0.371	0.763
	8	0.125	0.309	-0.327	-0.095	0.095	0.313	0.678
Cadet Preference	0	1.210	0.598	1.000	1.000	1.000	1.000	2.000
	1	1.028	0.165	1.000	1.000	1.000	1.000	1.000
	2	7.341	4.914	1.000	3.000	7.000	12.000	16.000
	3	8.451	4.959	1.000	4.000	8.000	13.000	16.000
	4	8.545	4.746	1.000	4.000	8.000	13.000	16.000
	5	6.133	5.056	1.000	1.000	5.000	10.000	16.000
	6	4.762	4.867	1.000	1.000	2.000	8.000	15.000
	7	3.819	4.473	1.000	1.000	1.000	5.000	14.000
	8	7.726	4.810	1.000	3.000	7.000	12.000	16.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.16. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Ordnance Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.016	0.291	-0.467	-0.195	-0.023	0.169	0.423
	1	-0.038	0.318	-0.564	-0.271	-0.024	0.197	0.467
	2	0.228	0.217	-0.109	0.069	0.223	0.375	0.596
	3	-0.061	0.270	-0.516	-0.247	-0.058	0.127	0.369
	4	0.075	0.276	-0.398	-0.104	0.084	0.269	0.510
	5	0.184	0.196	-0.120	0.044	0.177	0.311	0.519
	6	0.140	0.193	-0.152	0.007	0.124	0.262	0.479
	7	0.108	0.217	-0.236	-0.038	0.100	0.248	0.480
	8	0.214	0.258	-0.250	0.064	0.239	0.390	0.594
Career Continuance	0	0.964	0.020	0.927	0.954	0.968	0.978	0.989
	1	0.969	0.019	0.930	0.960	0.973	0.982	0.991
	2	0.969	0.018	0.935	0.961	0.973	0.981	0.990
	3	0.968	0.018	0.932	0.960	0.972	0.981	0.990
	4	0.984	0.006	0.975	0.981	0.984	0.988	0.994
	5	0.970	0.017	0.939	0.963	0.974	0.982	0.990
	6	0.969	0.019	0.933	0.960	0.973	0.982	0.990
	7	0.968	0.018	0.933	0.959	0.972	0.981	0.990
	8	0.976	0.015	0.948	0.971	0.979	0.985	0.991
Branch Satisfaction	0	-0.036	0.141	-0.273	-0.133	-0.043	0.051	0.198
	1	-0.003	0.137	-0.223	-0.095	-0.007	0.088	0.227
	2	-0.011	0.129	-0.213	-0.101	-0.016	0.071	0.211
	3	0.048	0.105	-0.109	-0.024	0.040	0.113	0.230
	4	0.034	0.132	-0.175	-0.059	0.027	0.122	0.261
	5	-0.008	0.130	-0.207	-0.098	-0.014	0.076	0.212
	6	-0.010	0.135	-0.223	-0.103	-0.014	0.079	0.220
	7	-0.010	0.132	-0.218	-0.101	-0.014	0.075	0.213
	8	-0.021	0.135	-0.224	-0.115	-0.032	0.061	0.219
Cadet Preference	0	2.961	2.015	1.000	1.000	2.000	4.000	7.000
	1	2.526	1.592	1.000	1.000	2.000	3.000	6.000
	2	4.903	2.494	1.000	3.000	5.000	7.000	9.000
	3	4.629	2.477	1.000	3.000	4.000	6.000	9.000
	4	4.905	2.430	1.000	3.000	5.000	7.000	9.000
	5	4.744	2.478	1.000	3.000	5.000	7.000	9.000
	6	3.707	2.289	1.000	2.000	3.000	5.000	8.000
	7	3.339	2.220	1.000	2.000	3.000	4.000	8.000
	8	4.936	2.428	1.000	3.000	5.000	7.000	9.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.17. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Transportation Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.004	0.299	-0.485	-0.180	0.033	0.208	0.453
	1	0.014	0.292	-0.481	-0.189	0.029	0.223	0.479
	2	0.227	0.218	-0.111	0.065	0.222	0.372	0.603
	3	-0.062	0.263	-0.496	-0.242	-0.059	0.122	0.361
	4	0.065	0.284	-0.420	-0.121	0.081	0.266	0.515
	5	0.191	0.193	-0.115	0.056	0.186	0.319	0.521
	6	0.153	0.195	-0.141	0.015	0.142	0.280	0.489
	7	0.124	0.217	-0.218	-0.024	0.118	0.265	0.489
	8	0.207	0.263	-0.274	0.055	0.235	0.387	0.592
Career Continuance	0	0.964	0.021	0.930	0.954	0.968	0.979	0.991
	1	0.967	0.019	0.929	0.958	0.971	0.981	0.990
	2	0.969	0.018	0.933	0.960	0.973	0.982	0.990
	3	0.968	0.018	0.933	0.959	0.972	0.981	0.991
	4	0.984	0.006	0.975	0.980	0.984	0.988	0.993
	5	0.970	0.017	0.937	0.962	0.973	0.982	0.990
	6	0.968	0.020	0.930	0.959	0.972	0.981	0.990
	7	0.967	0.019	0.930	0.958	0.971	0.981	0.990
	8	0.975	0.016	0.946	0.970	0.979	0.985	0.991
Branch Satisfaction	0	-0.000	0.146	-0.218	-0.105	-0.007	0.093	0.237
	1	0.001	0.138	-0.213	-0.095	-0.003	0.090	0.238
	2	-0.005	0.133	-0.209	-0.095	-0.013	0.079	0.225
	3	0.051	0.105	-0.106	-0.020	0.043	0.114	0.240
	4	0.037	0.131	-0.169	-0.057	0.028	0.126	0.260
	5	-0.005	0.132	-0.210	-0.095	-0.010	0.080	0.219
	6	-0.011	0.134	-0.218	-0.104	-0.016	0.073	0.213
	7	-0.004	0.137	-0.217	-0.099	-0.007	0.083	0.228
	8	-0.014	0.139	-0.220	-0.113	-0.026	0.074	0.236
Cadet Preference	0	2.428	1.606	1.000	1.000	2.000	3.000	6.000
	1	1.907	0.975	1.000	1.000	2.000	2.000	3.000
	2	4.294	2.353	1.000	2.000	4.000	6.000	9.000
	3	3.957	2.292	1.000	2.000	4.000	5.000	8.000
	4	4.472	2.300	1.000	3.000	4.000	6.000	8.000
	5	4.059	2.333	1.000	2.000	4.000	6.000	8.000
	6	3.287	2.127	1.000	2.000	3.000	4.000	8.000
	7	2.886	1.938	1.000	2.000	2.000	3.000	7.000
	8	4.337	2.308	1.000	2.000	4.000	6.000	8.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.18. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Quartermaster Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	-0.054	0.309	-0.569	-0.259	-0.035	0.154	0.424
	1	0.007	0.290	-0.473	-0.195	0.011	0.216	0.471
	2	0.213	0.220	-0.123	0.051	0.207	0.360	0.595
	3	-0.067	0.276	-0.528	-0.254	-0.059	0.127	0.365
	4	0.051	0.290	-0.456	-0.134	0.066	0.253	0.503
	5	0.178	0.203	-0.130	0.038	0.168	0.307	0.530
	6	0.143	0.205	-0.168	0.003	0.132	0.269	0.513
	7	0.112	0.216	-0.224	-0.035	0.097	0.254	0.476
	8	0.191	0.275	-0.323	0.038	0.221	0.382	0.587
Career Continuance	0	0.966	0.022	0.929	0.956	0.970	0.981	0.992
	1	0.967	0.020	0.928	0.958	0.971	0.981	0.990
	2	0.969	0.019	0.934	0.962	0.973	0.982	0.990
	3	0.968	0.018	0.933	0.959	0.972	0.981	0.990
	4	0.984	0.006	0.975	0.981	0.984	0.989	0.994
	5	0.970	0.017	0.939	0.962	0.974	0.982	0.990
	6	0.967	0.020	0.928	0.958	0.972	0.981	0.990
	7	0.967	0.020	0.928	0.958	0.972	0.981	0.990
	8	0.976	0.016	0.949	0.971	0.979	0.985	0.992
Branch Satisfaction	0	0.014	0.153	-0.221	-0.086	0.009	0.096	0.287
	1	0.018	0.138	-0.198	-0.073	0.014	0.105	0.253
	2	0.023	0.135	-0.184	-0.070	0.019	0.107	0.254
	3	0.058	0.105	-0.097	-0.015	0.051	0.123	0.243
	4	0.064	0.135	-0.148	-0.031	0.058	0.152	0.297
	5	0.020	0.133	-0.190	-0.071	0.015	0.105	0.248
	6	0.015	0.135	-0.197	-0.076	0.010	0.102	0.244
	7	0.015	0.137	-0.196	-0.078	0.009	0.105	0.250
	8	0.014	0.140	-0.193	-0.083	0.001	0.103	0.261
Cadet Preference	0	2.166	1.800	1.000	1.000	2.000	3.000	5.000
	1	1.764	0.864	1.000	1.000	2.000	2.000	3.000
	2	4.225	2.440	1.000	2.000	4.000	6.000	9.000
	3	3.898	2.286	1.000	2.000	4.000	5.000	8.000
	4	4.282	2.411	1.000	2.000	4.000	6.000	9.000
	5	4.070	2.466	1.000	2.000	4.000	6.000	9.000
	6	3.250	2.223	1.000	2.000	3.000	4.000	8.000
	7	2.806	1.962	1.000	1.000	2.000	3.000	7.000
	8	4.456	2.495	1.000	2.000	4.000	6.000	9.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.19. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Adjutant General Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.022	0.300	-0.488	-0.149	0.034	0.217	0.492
	1	-0.042	0.359	-0.661	-0.304	-0.023	0.226	0.510
	2	0.250	0.223	-0.104	0.092	0.248	0.395	0.636
	3	-0.050	0.280	-0.518	-0.242	-0.043	0.150	0.391
	4	0.080	0.294	-0.426	-0.115	0.094	0.282	0.541
	5	0.212	0.201	-0.101	0.073	0.206	0.338	0.561
	6	0.163	0.204	-0.136	0.016	0.143	0.291	0.531
	7	0.120	0.240	-0.262	-0.035	0.114	0.269	0.520
	8	0.238	0.265	-0.222	0.086	0.261	0.419	0.627
Career Continuance	0	0.961	0.023	0.922	0.949	0.965	0.978	0.991
	1	0.968	0.021	0.928	0.959	0.973	0.983	0.991
	2	0.969	0.019	0.933	0.961	0.973	0.982	0.990
	3	0.968	0.019	0.932	0.959	0.972	0.981	0.991
	4	0.985	0.006	0.975	0.981	0.985	0.989	0.994
	5	0.970	0.017	0.936	0.962	0.974	0.982	0.990
	6	0.969	0.020	0.931	0.961	0.973	0.982	0.990
	7	0.968	0.020	0.930	0.960	0.972	0.982	0.991
	8	0.976	0.016	0.947	0.971	0.979	0.985	0.992
Branch Satisfaction	0	0.024	0.155	-0.206	-0.082	0.017	0.112	0.306
	1	0.042	0.139	-0.181	-0.055	0.039	0.131	0.276
	2	0.028	0.137	-0.189	-0.067	0.027	0.117	0.257
	3	0.064	0.106	-0.093	-0.010	0.055	0.127	0.248
	4	0.071	0.139	-0.143	-0.025	0.063	0.157	0.318
	5	0.031	0.137	-0.183	-0.063	0.028	0.118	0.264
	6	0.034	0.135	-0.179	-0.057	0.030	0.119	0.266
	7	0.036	0.138	-0.188	-0.057	0.034	0.125	0.268
	8	0.020	0.142	-0.194	-0.081	0.009	0.111	0.270
Cadet Preference	0	3.015	2.459	1.000	1.000	2.000	4.000	9.000
	1	2.725	2.343	1.000	1.000	2.000	3.000	8.000
	2	4.854	2.827	1.000	3.000	4.000	7.000	10.000
	3	4.958	2.835	1.000	3.000	5.000	7.000	10.000
	4	5.428	3.029	1.000	3.000	5.000	8.000	11.000
	5	4.776	2.899	1.000	2.000	4.000	7.000	10.000
	6	3.868	2.683	1.000	2.000	3.000	5.000	10.000
	7	3.370	2.567	1.000	2.000	3.000	4.000	9.000
	8	5.319	2.964	1.000	3.000	5.000	7.000	11.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Table D.20. Descriptive Statistics of Simulated Cadet Score Distribution by Condition - Finance Corps

Criterion	Condition	*M*	*SD*	p05	p25	p50	p75	p95
Officer Performance	0	0.131	0.297	-0.343	-0.115	0.159	0.322	0.551
	1	0.106	0.288	-0.391	-0.093	0.116	0.300	0.566
	2	0.255	0.215	-0.089	0.105	0.257	0.397	0.619
	3	-0.036	0.275	-0.473	-0.226	-0.030	0.150	0.420
	4	0.086	0.283	-0.402	-0.100	0.106	0.284	0.533
	5	0.215	0.206	-0.111	0.073	0.204	0.343	0.579
	6	0.186	0.207	-0.117	0.039	0.168	0.315	0.569
	7	0.164	0.233	-0.185	-0.000	0.147	0.315	0.568
	8	0.246	0.251	-0.178	0.094	0.264	0.419	0.602
Career Continuance	0	0.960	0.023	0.922	0.945	0.962	0.977	0.991
	1	0.966	0.021	0.924	0.956	0.970	0.981	0.991
	2	0.968	0.020	0.929	0.959	0.973	0.982	0.991
	3	0.968	0.019	0.931	0.959	0.971	0.981	0.991
	4	0.985	0.006	0.976	0.981	0.985	0.989	0.995
	5	0.969	0.019	0.932	0.960	0.973	0.982	0.990
	6	0.967	0.019	0.930	0.958	0.971	0.981	0.991
	7	0.967	0.021	0.929	0.957	0.972	0.981	0.991
	8	0.974	0.018	0.940	0.970	0.978	0.985	0.991
Branch Satisfaction	0	0.017	0.160	-0.203	-0.078	0.006	0.087	0.295
	1	0.029	0.143	-0.195	-0.070	0.025	0.125	0.275
	2	0.010	0.139	-0.208	-0.086	0.007	0.100	0.249
	3	0.061	0.108	-0.097	-0.014	0.052	0.126	0.251
	4	0.070	0.139	-0.146	-0.029	0.059	0.161	0.312
	5	0.014	0.141	-0.211	-0.083	0.007	0.108	0.267
	6	0.008	0.142	-0.212	-0.090	0.001	0.099	0.255
	7	0.014	0.143	-0.207	-0.079	0.008	0.098	0.254
	8	0.011	0.144	-0.211	-0.084	-0.003	0.102	0.258
Cadet Preference	0	1.376	0.904	1.000	1.000	1.000	1.000	3.000
	1	1.407	0.657	1.000	1.000	1.000	2.000	3.000
	2	3.647	2.346	1.000	2.000	3.000	5.000	8.000
	3	3.757	2.323	1.000	2.000	3.000	5.000	8.000
	4	4.354	2.556	1.000	2.000	4.000	6.000	9.000
	5	3.478	2.396	1.000	1.000	3.000	5.000	8.000
	6	2.770	2.156	1.000	1.000	2.000	4.000	7.000
	7	2.524	1.976	1.000	1.000	2.000	3.000	7.000
	8	3.919	2.366	1.000	2.000	4.000	5.000	8.000

Note. Condition 0 = data from Validation Sample. Simulation conditions are 1 = current branching process that focuses on cadet preference, 2 = optimization of officer performance, 3 = optimization of branch satisfaction, 4 = optimization of career continuance/retention, 5 – 7 = simulated elements of the current branching system while optimizing officer performance, 8 = optimization of a combination of officer performance and career continuance.

Figures D.13 and D.14 relate the standard deviation of branch satisfaction and career continuance predictions to the validity of the predictions of these values. For branch satisfaction, there was a substantial positive relationship between the standard deviation of the median across conditions and the validity of the regression equation assessing the criterion, producing an order-of-magnitude increase over the range of validity. This result suggests that optimization is more effective for branches for which satisfaction can be predicted more accurately.

Although the positive relationship also is present for career continuance, the results were not as consistent for this criterion. Also notable were the generally lower validity for career continuance, compared to the other criteria, and the extremely small standard deviations of the median across conditions.

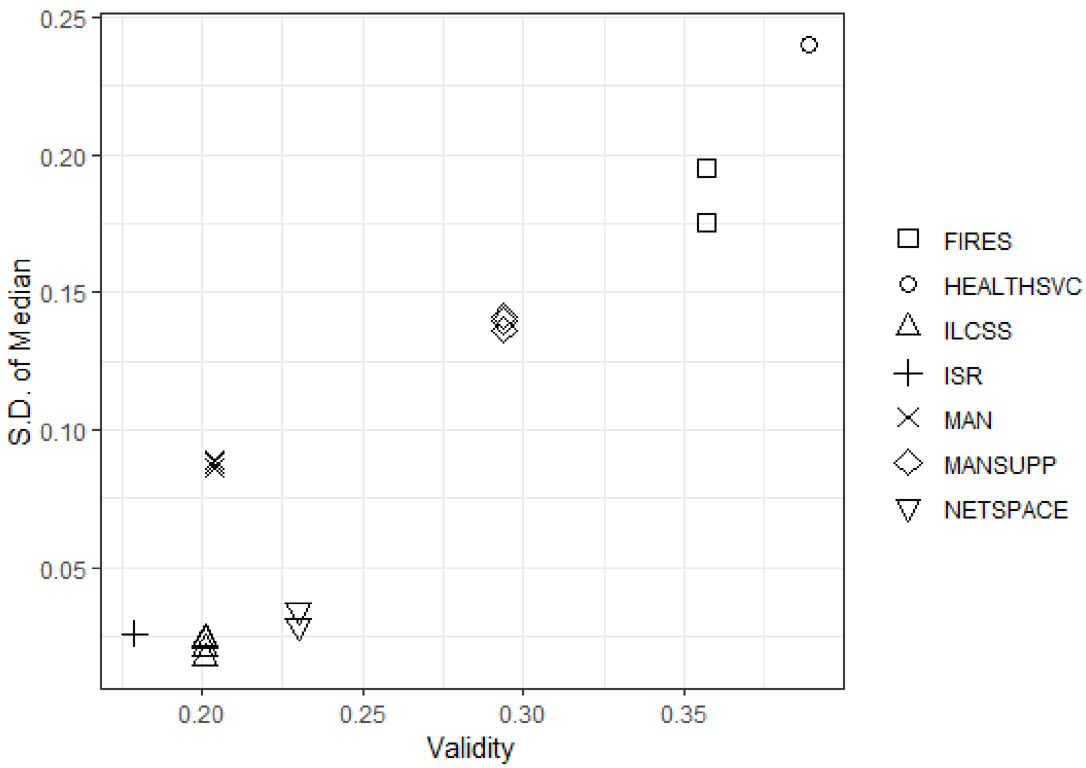


Figure D.13. Cluster branch satisfaction validity (BMA) and standard deviation of median across conditions.

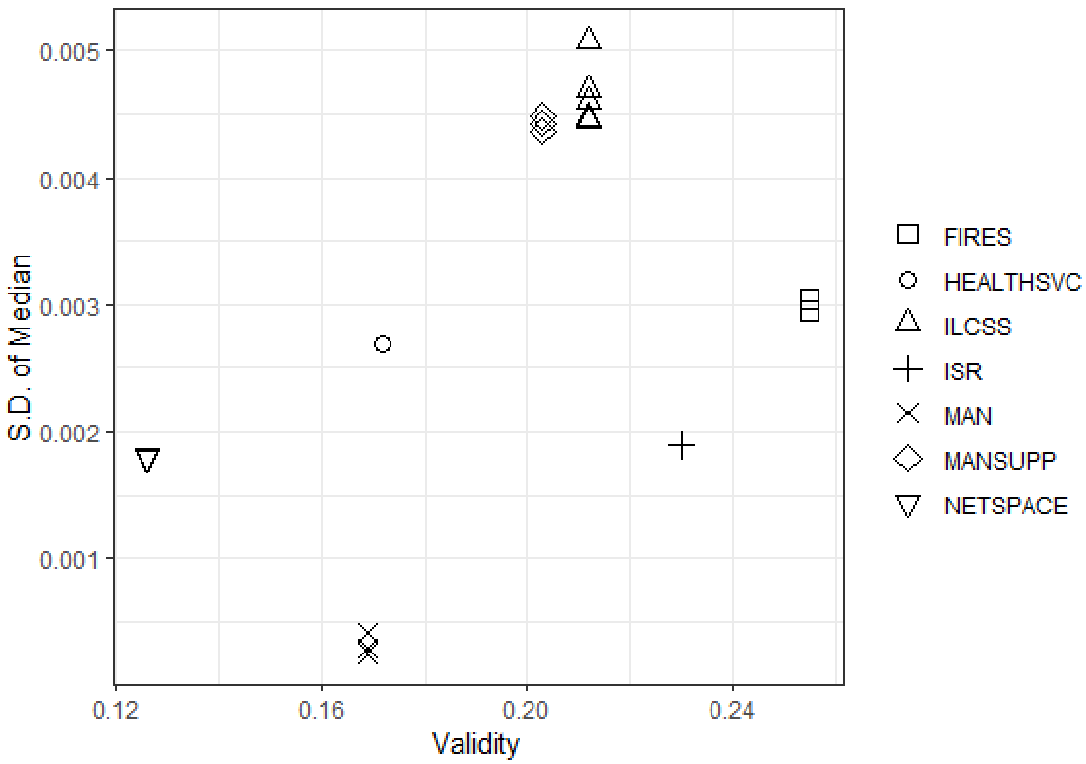


Figure D.14. Cluster career continuance validity (BMA) and standard deviation of median across conditions.